Introduction

Purpose. The purpose of this document is to provide a complete socioeconomic impact analysis for the proposed network of marine reserves (no take areas) in the Channel Islands National Marine Sanctuary (CINMS). The report provides analyses for six alternative networks, and within each alternative, two jurisdictions (e.g., State and Federal). The jurisdiction results have been mislabeled as Phase 1 and Phase 2 in some preliminary work. The original intent of this labeling was to distinguish administrative processes that would each be on separate time paths. However, the term phasing has socioeconomic implications and we have dropped the use of the term phases when what is really meant are the jurisdictions (State and Federal). The time dimensions of the State and Federal processes will only differ by months or a year. Phasing has socioeconomic significance because it is a strategy that can be used to minimize socioeconomic impacts by giving displaced users more time to adapt.

This document also provides background materials that were generated over a two-year time period and provided to the Marine Reserve Working Group (MRWG) to assist them in their attempt to design a network of marine reserves for the CINMS. Background materials, detailed documentation of methods and further tabular details of analyses are provided in appendices. This document will serve as the main reference document for the Socioeconomic Impact Analyses in future Environmental Impact Statements and Regulatory Impact Reviews to be produced by the State and Federal governments.

Approach. Analyses are provided in two steps. Step 1 analyses are very quantitative and many detailed tables are produced. ***Step 1 analyses*** simply add-up all the activities displaced from marine reserve areas, with the assumption that all is lost, i.e., there is no mitigation or off-sets through behavioral responses. Substitution/relocation, replenishment effects, the effects of other regulations, the current and future status of fishing stocks, and the benefits of marine reserves are not addressed in Step1 analyses. We have generally labeled the Step 1 analyses as "***maximum potential loss***". In cases where congestion effects occur due to displacement and relocation of fishing effort, losses could exceed our estimates of maximum potential loss.

It is rare, however, for there not being some possibilities for substitution and relocation to mitigate or off-set impacts. Human beings have proven to be quite ingenious, adaptive and resilient in the face of change and often surprise us with solutions that the rest of us could never have imagined. ***Step 2 analyses*** are by their nature less quantitative. We simply are not capable of forecasting all the human responses as well as the ecological-biological responses, and the interaction of these systems that will result from the network of marine reserves. All the benefits and costs of marine reserves cannot be quantified, and so a formal benefit-cost analysis is not conducted. Instead, we use the benefit-cost framework and list all the potential benefits and costs, and quantify them where we can. Where we can't quantify benefits or costs, we discuss them qualitatively and in what direction we believe benefits or costs will move (under various conditions), from the point of our estimate of losses from Step 1 analyses.

Our socioeconomic impact analysis will surely seem weighted more heavily toward the economic and less towards the social impacts. We provide extensive profiles of commercial fishermen, measures of their dependency on CINMS resources, the extent of impacts on samples of individual fishermen, and information relevant to assessing the ability to adapt to change. We attempt to provide some interpretation in a rudimentary social impact analysis. For the recreation industry, there is much less information on the social side. The recreation industry is diverse and employs many people spread across many industries. Profiles of the direct recreational users and all the suppliers of recreational services were not available.

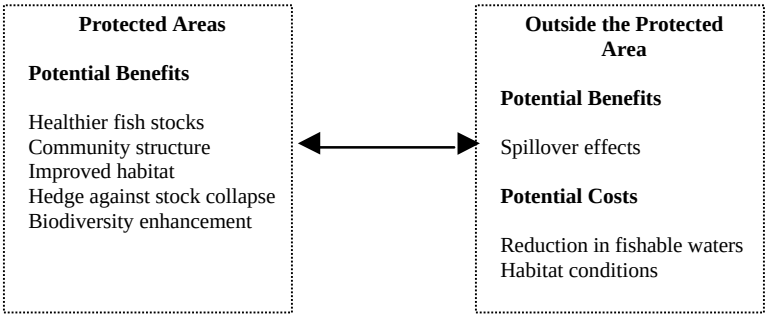
The analyses of the impacts of marine reserves are generally about what will happen in the future. So by its nature, our analyses will be characterized by great ***uncertainty***. Although we have assembled considerable information and our Step 1 analyses yield good starting points to assess the potential impacts, the uncertainties of human and biophysical responses, and the interaction between them, make the results of the Step 2 analyses less certain. We have used theoretical models from socioeconomic literature to guide us through Step 2 analyses and establish under what conditions and which direction we could expect benefits and/or costs to go.

The information and analyses presented here provide critical baseline information to contribute to the adaptive management of the Channel Islands National Marine Sanctuary. The use of ***monitoring*** to address uncertainty is fundamental to the practice of ***adaptive management***. We regard the information and analyses presented here as a first step in the adaptive management process.

Benefits and Costs of Marine Reserves (no take areas)

There are two perspectives on identifying the benefits and costs of marine reserves. The first focuses on the potential biophysical benefits and costs. Sanchirico (2000) has provided a simple summary of these benefits and costs (Figure 1). These are issues for which the Science Panel for the Marine Reserves of the CINMS has summarized the literature supporting the biophysical benefits and costs. A key distinction is the closed areas themselves versus the areas outside the closed areas, and the linkages between the areas. As Sanchirico and Wilen (2001) have shown, the biophysical benefits and costs are contingent on socioeconomic behavioral responses. So even though socioeconomic benefits and costs are dependent on the biophysical benefits and costs, the biophysical benefits and costs are predicated on socioeconomic behavioral responses. The determination of final outcomes is dependent upon both how both the natural environment and humans respond to the protection strategy.

Figure 1. Potential Ecological/Biological Benefits and Costs of Marine Reserves



The boundaries of the two areas are drawn with dashed lines to symbolize the openness of the marine ecosystem. The link between the two areas is formally defined by the migration/dispersal patterns of fish stocks residing within and outside the protected areas along with the geographic or oceanographic characteristics of the marine environment. In general, fish migration patters depend upon currents, temperatures, prevailing winds, and behavioral characteristics. The term "community structure" refers to the potential benefits in age/size structure of the fish stock and in trophic levels present in the protected area.

Source: Sanchirico (2000)

The second perspective on benefits and costs of marine reserves is the socioeconomic benefits and costs. As stated above, they are both contingent on the biophysical benefits and costs and on socioeconomic behavioral responses. In addition, there is a time dimension to benefits and costs. For purposes of our analyses, the short-term is defined as one to five years and the long-term, beyond five years. Below we list each potential benefit and cost along with each user group that would receive each benefit and/or cost and what measurement we would use to quantify or describe qualitatively the benefit and/or cost.

A. Potential Benefits

1. Non-consumptive Users (sport divers and wildlife viewers)

Since marine reserves will continue to allow non-consumptive activities, these user groups are potential beneficiaries. Over time it is expected that the closed areas will increase in quality. Marine reserves also may reduce conflicts with consumptive users. This will attract additional non-consumptive users, which will increase demand for services and have impacts on the local economies. In addition, the quality increase is expected to increase the net user value (consumer's surplus) per unit of use (measured as person-days). Consumer's surplus or net user value by non-consumptive users is also sometimes referred to as non-market economic use value. Below is a list of potential benefits to non-consumptive users.

- Increased sales and income to businesses directly providing goods and services to non-consumptive users.
- Secondary increases in sales/output, income, jobs and tax revenues in the local economies (through economic multiplier impacts).
- Increase in Consumer's surplus or net economic user value (non-market economic use value).

2. Nonusers or Passive Users

Economists have long recognized a special class of non-market economic values for natural resources and the environment referred to generally as nonuse or passive use economic value. See Kopp and Smith (1993) for a detailed discussion. These values are widely accepted as legitimate values to include in benefit-cost analyses of environmental regulations and in damage assessment cases. The term passive use, instead of nonuse, has become more popular because it is recognized that for people to have value for something they must have some knowledge about what they are valuing. People learn about natural resources or the environment they are asked to value through books, newspapers, magazines, newsletters, radio, television and other media sources. The people don't actually visit the sites and directly use the resources protected themselves, they consume them passively through the many indirect sources. The values have been referred to in the literature as option value, bequest value and existence value to clarify people's underlying motives for their willingness to pay.

Definitions

Consumer's Surplus: The amount that a person is willing to pay for a good or service over and above what they actually have to pay for a good or service. The value received is a surplus or net benefit. And, for natural resources, for which no one owns the resources and can't charge a price for use of the resources, consumer's surplus is referred to as a non-market economic value since the goods and services from the natural resources are not traded in markets. Consumer's surplus is applicable to both use and nonuse or passive use value.

Option Value: The value to current non-users who would be willing to pay an amount to ensure possible future use. This value is based upon uncertainty about both their future demand and the state of future supply. One can think of this like buying an insurance policy for future use. Weisbrod (1964) first introduced the concept of option value. Bishop (1982) extends and further clarifies this concept.

Quasi-Option Value: The value of preserving options for future use given some expectation of the growth of knowledge. Quasi-option value is positive when there are uncertainties about the future benefits of preservation and negative when the uncertainties are about future development issues. Examples are issues about future scientific discoveries or commercial applications that might arise from future study. Fisher and Hanemann (1987) discuss and clarify this concept. To the extent that consumptive uses might eliminate certain resources, this concept becomes an important potential benefit of marine reserves.

Bequest Value: The value to people that never plan to visit, but would be willing to pay an amount to ensure that future generations can experience the area in a certain protected condition.

Existence Value: The value to people who never plan to visit, but would be willing to pay an amount to ensure the resource exists in a certain protected condition. Krutilla (1967) first introduced the concepts of bequest and existence values. Brookshire, Eubanks and Randall (1983) discuss important issues in estimating these values.

Economic Rent: A return on investment over and above a normal rate of return on investment. A normal rate of return on investment is that rate of return in which incentives are such that capital will neither outflow or inflow into the industry.

For nonconsumptive users and passive users, the conditions of the ecosystem are important for determining the benefits of marine reserves. Marine reserves are known to change the status of the habitats protected

and often result in changes in community structure and increased biodiversity. Also, one of the main benefits is the possibility of protecting a different functioning ecosystem (i.e., a more natural system with minimum influence by man). These may be conditions for which these user groups would have a willingness to pay.

2. Commercial Fishing and Kelp Harvesting

Commercial fishing and kelp harvesting are displaced activities from marine reserves and so these user groups would be expected to suffer losses and can therefore be placed under potential costs. However, if marine reserves result in benefits to surrounding unprotected sites, i.e., increases in biomass and aggregate harvests, the commercial fishing industry will be a beneficiary. The benefits of marine reserves are usually stated as long-term benefits given the time frames necessary for habitats and fish stocks to improve. Below is a list of expected long-term benefits to commercial fishing.

- Long-term increases in harvest revenue and income to fishermen.
- Long-term increases in secondary output/sales, income, jobs and tax revenues in local economies. (Through economic multiplier impacts).
- Long-term increases in Consumer's Surplus to consumers of commercial fishing products (if prices to consumers decline with increased harvests).
- Long-term increases in Economic Rents (may or may not exist in open access fisheries)[1].

3. Recreational Fishing and Consumptive Diving

Just as with commercial fishing, recreational fishing and consumptive diving are displaced activities from marine reserves, and so these groups associated with these activities are expected to suffer losses, which constitute negative potential impacts or potential costs. However, if marine reserves result in benefits to surrounding unprotected sites, i.e., increases in biomass and aggregate harvests, the recreational fishermen and consumptive divers, and supporting industries will be beneficiaries. The basis for these benefits is the potential increase in quality of the experience including the number and size of catch and possibly reduced conflicts with other users. The benefits of marine reserves are usually stated as long-term benefits given the time frames necessary for fish stocks to improve. Below is a list of expected long-term benefits to recreational fishing and consumptive diving.

- Long-term increases in sales and income to businesses that directly provide goods and services to recreational fishermen and consumptive divers.
- Long-term increases in secondary output/sales, income, jobs and tax revenues in local economies (through economic multiplier impacts).
- Long-term increase in Consumer's Surplus.
- Long-term increases in Economic Rent (may or may not exist in open access fishery).

4. Scientific and Education Values

Marine reserves provide a multitude of scientific and educational values. Sobel (1996) provides a list of these benefits. Scientific and education values were categorized by Sobel into those things reserves provide that increase knowledge and understanding of marine systems. Sobel provided the following list of benefits:

Scientific

- Provides long-term monitoring sites
- Provides focus for study
- Provides continuity of knowledge in undisturbed sites
- Provides opportunity to restore or maintain natural behaviors
- Reduces risk to long-term experiments

- Provides controlled natural areas for assessing anthropogenic impacts, including fishing and other impacts

Education

- Provides sites for enhanced primary and adult education
- Provides sites for high-level graduate education

B. Potential Costs

1. Commercial Fishing and Kelp Harvesting

As mentioned above, commercial fishing is one of the displaced activities from marine reserves. Sanchirico and Wilen (2001) discuss the biophysical and socioeconomic conditions under which commercial fisheries might benefit or suffer costs from marine reserves. There are sets of conditions under which they predict would result in short-term and/or long-term costs.

- Lost harvest revenue and income to fishermen and processors.
- Secondary losses in output/sales, income, jobs and tax revenues in local economies (through economic multiplier process).
- No loss in harvest but increased cost of harvesting resulting in lost income to fishermen.
- Losses in Consumer's Surplus to consumers of commercial seafood products (if prices rise for fishery products due to reductions in harvests).
- Overcrowding, User conflicts, Possible Overfishing or Habitat destruction in remaining open areas due to displacement. This could raise costs and/or lower harvests.
- With displacement, loss of site-specific harvest knowledge that supports sustainable fishing practices.
- Social disruptions from losses in incomes and jobs.

The extent to which these costs are realized in the short-term or long-term depends greatly on the off-site impacts of the protected areas as listed in Figure 1, but also on the status of the fish stocks fishery management regulations (are current harvest levels sustainable?), and the behavioral responses and economic conditions of the fishing industry. It is not always true that there will even be short-term losses (Leeworthy, 2001a).

2. Recreational Fishing and Consumptive Diving

As mentioned above, recreational fishing and consumptive diving would be displaced from marine reserves. Sanchirico and Wilen (2001) discuss the biophysical and socioeconomic conditions under which these user groups might benefit or suffer costs from marine reserves. There are sets of conditions under which they predict would result in short-term and/or long-term costs.

- Lost sales revenue and income to businesses that directly provide goods and services to recreational fishermen and consumptive divers.
- Secondary losses in output/sales, income, jobs and tax revenues in local economies (through economic multiplier impacts).
- Losses in Consumer's Surplus (if consumptive users are forced to substitute to less valued locations or if they are crowded into remaining open areas where they experience congestion effects or if it costs more to relocate to other areas).
- Losses in Economic Rent (may or may not exist in open access environment).

As with the commercial fisheries, whether any of the above costs are short-term or long-term depends greatly on the off-site impacts of the protected areas as listed in Figure 1, but also status of the fish stocks fishery management regulations (are current harvest levels sustainable?), and on the behavioral responses

and economic conditions of the consumptive recreational industry. It is not always true that there will even be short-term losses if there are adequate substitute sites.

Ports and Harbors. Those involved in managing ports and harbors have expressed concern with respect to both boundary expansion and marine reserves in the CINMS may have a negative impact on ports and harbors, if these actions result in decreases in business volume. The concern goes beyond the impacts described above and is focused on the issue of how the Federal government (the U.S. Army Corps of Engineers and Congress) make decisions about funding for dredging to maintain ports and harbors. Our economic impact estimates do provide some details on ports and harbors and can be used to assess these indirect effects. As with the above, there might be short-term gains and losses in business volume (gains to nonconsumptive users and losses to consumptive users) and their might be long-term gains for all users. Thus, there is a possibility of both benefits and costs to ports and harbors.

Outline of the Report

In Chapter 1, we provide a socioeconomic overview of the study area. There we define the various study areas and background socioeconomic descriptions of the study area. Also provided are baseline estimates of commercial fishing activity and recreational activities and how they are connected to the local economies. Here we also show what we were able to quantify in our Step 1 analyses and document our data and models.

Chapter 2 includes our Step 1 analyses of the marine reserve alternatives. Results are generated at very detailed levels, so we include summary tables in the chapter and place the tables with greater details in appendices.

Chapter 3 includes our Step 2 analyses of alternatives. Here we attempt to assess how likely are the losses estimated in our Step 1 analyses are to occur. We also include an assessment of the potential benefits of the marine reserves and a summary net assessment.

Appendix G – Preferred Alternative is added to the report to provide an area-by-area Step 1 analysis. We don't provide all the tables with all the details as we do for complete alternatives since this would require hundreds of tables. Instead here we provide a set of summary tables for each user group potentially impacted. Details will be available from the authors upon request.

Appendix H – This appendix was added to address an analysis conducted by Robert Southwick of Southwick and Associates for the American Sportfishing Association (ASA). The ASA criticizes our previous step 1 analyses for MRWG options A through D arguing that our analyses are flawed and under estimate the impact to recreational support industries. Our expenditure profiles for recreational fishermen were the major criticism - that we used older outdated data and did not include equipment purchases. The inclusion of all major equipment expenditures in the ASA report would not be appropriate for analyzing the impacts of marine reserves. We provide updated estimates using the new trip expenditures and explain the reason the ASA approach is flawed.

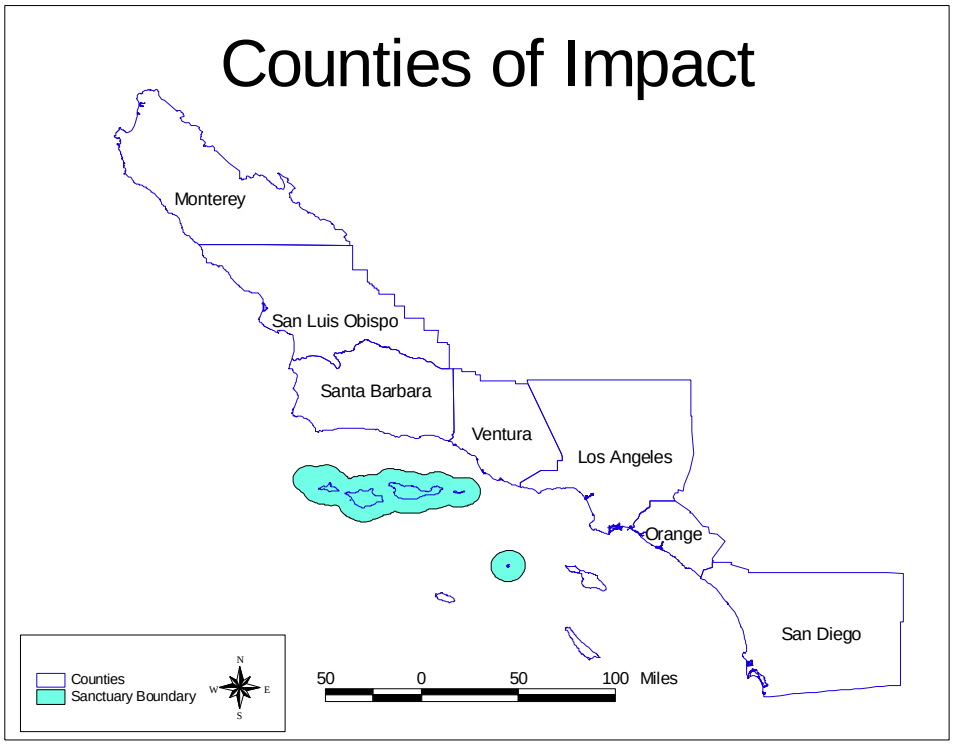
Chapter 1

A Socioeconomic Overview of the Study Area

Study Areas and Economic Dependence on the CINMS

There are two fundamental definitions of the study area. First is the where the activities take place that use the natural resources and the second is the place where the economic and social impacts take place. For the first area, the definition is the area within the boundaries of the CINMS or six nautical miles seaward of the Channel Islands (see maps in Appendix C). For the second area, we relied on several sources of information: 1) California Department of Fish and Game (CDFG) commercial fishing data that shows for each area where fish are caught, the ports where the fish are landed, 2) data from contractor Pomeroy's research on the squid/wetfish fishery on the spatial organization of squid processing (see also Pomeroy and Fitzsimmons 2001), 3) kelp harvesting and processing information was obtained form ISP Alginates, 4) data from our surveys of recreational for-hire operators on their base of operations and 5) National Marine Fisheries Service, Marine Recreational Fishing Statistics Survey for intercept/access points for those fishing from private household boats. Appendix B includes a report that details our data collection and estimation methods. Figure 2 shows a map of the seven-county area we defined as the area of socioeconomic impact. All seven counties are impacted by commercial fishing activities and three counties (e.g., Santa Barbara, Ventura and Los Angeles) are impacted by recreational activities.

Figure 2. Socioeconomic Impact Area for the Channel Islands National Marine Sanctuary (CINMS)



The seven-county impact area had a 2000 population of over 16.98 million. Between 1990 and 2000, the population of the study area grew at a slower pace than the entire State of California or the U.S. (Table 1.1). The seven-county area had a much higher population density and higher poverty rate than either the

State of California or the U.S. The higher population densities are mostly influenced by the inclusion of Los Angles and Orange counties, which have extremely high population densities, while the relatively high poverty rate is due to Los Angeles County. For per capita income, the seven-county area is higher than the U.S. but lower than the State of California.

Table 1.1 Selected Socioeconomic Measures for Description of Impact Areas

County	2000 Population	Population Change 1990-2000	Population Density[1]	1999 Per Capita Income	1997 Persons Below Poverty
Monterey	401,762	13.0%	120.9	$29,393	15.4%
San Luis Obispo	246,681	13.6%	74.7	$25,888	12.9%
Santa Barbara	399,347	8.0%	145.9	$30,218	14.6%
Ventura	753,197	12.6%	408.2	$29,639	10.3%
Los Angeles	9,519,338	7.4%	2,344.1	$28,276	20.5%
Orange	2,846,289	18.1%	3,607.5	$33,805	11.0%
San Diego	2,813,833	12.6%	670.0	$29,489	14.2%
All Counties	16,980,447	10.4%	838.2	$28,932	17.0%
California	33,871,648	13.6%	217.2	$29,856	16.0%
U.S.	281,421,906	13.1%	79.6	$28,546	13.3%

1. Number of people per square mile.

Source: U.S. Department of Commerce, Bureau of the Census, State and County QuickFacts. (http://quickfacts.census.gov)

Before we can analyze the impact we need to establish the baseline relationship between the local economies (county economies) and the use of the CINMS. Table 1.2 shows personal income and employment by county for the seven-county impact area. Personal income is presented from two perspectives, by place of work and by place of residence. This is an important distinction because many county economies are less dependent on sources of income from work related activities in the county, i.e., they derived their incomes from sources outside the county. Sources of incomes from outside the county include retirement pensions, dividends and interest from investments and from work in other counties (commuters). All seven counties in the impact areas have larger personal incomes by place of residence than by place of work.

Table 1.2 Personal Income and Employment by County 1999

County	Personal Income By Work 000's $	Personal Income By Residence 000's $	Employment Number Full and Part time Jobs
Monterey	$7,568,214	$10,927,131	218,719
San Luis Obispo	$3,818,023	$6,134,244	137,169
Santa Barbara	$7,678,915	$11,817,328	244,175
Ventura	$13,612,027	$22,083,017	390,770
Los Angeles	$211,861,080	$263,814,766	5,369,705
Orange	$70,341,257	$93,332,511	1,801,299
San Diego	$60,296,132	$83,183,395	1,664,791
Region Total	$375,175,648	$491,292,392	9,826,628

Source: U.S. Department of Commerce, Bureau of Economic Analysis, Regional Information Management System (http://www.bea.gov)

We have estimated the economic impact of each of the activities in the CINMS on each of the seven counties in the impact area. The economic models are discussed in a latter section of this chapter. In 1999, all activities in the CINMS generated almost $172 million in personal income (Table 1.3). Our estimate of

employment (number of full and part-time jobs) is about 4.9 thousand. These estimates include the multiplier impacts in each county. However, the estimates are underestimates because we were not able to find any information on the amount of nonconsumptive recreation from private household boats. Including private household nonconsumptive recreation would probably result in estimates of between $180 and $190 million in income and between 5 and 5.5 thousand jobs that depend on the uses of the CINMS.

Table 1.3 Local/Regional Economic Dependence on CINMS: Personal Income, 1999

County		Commercial Fishing	Consumptive Recreation	Total Consumptive Activities	Nonconsumptive Recreation[1]	All Activities
Monterey		$19,316,416	0	$19,316,416	0	$19,316,416
	%[2]	0.1768	0	0.1768	0	0.1768
San Luis Obispo		$121,758	0	$121,758	0	$121,758
	%	0.0020	0	0.0020	0	0.0020
Santa Barbara		$15,041,824	$1,872,105	$16,913,929	$1,928,484	$18,842,413
	%	0.1273	0.0158	0.1431	0.0163	0.1594
Ventura		$79,190,758	$22,430,489	$101,621,247	$4,022,904	$105,644,151
	%	0.3586	0.1016	0.4602	0.0182	0.4784
Los Angeles		$18,452,223	$384,325	$18,836,548	$69,366	$18,905,914
	%	0.0070	0.0001	0.0071	0.0000	0.0072
Orange		$271	0	$271	0	$271
	%	0.0000	0	0.0000	0	0.0000
San Diego		$9,521,785	0	$9,521,785	0	$9,521,785
	%	0.0114	0	0.0114	0	0.0114
All Counties		$141,645,036	$24,686,919	$166,331,955	$6,020,754	$172,352,709
	%	0.0288	0.0050	0.0339	0.0012	0.0351

1. Nonconsumptive recreation and All Activities are under estimated because no information was available for nonconsumptive recreation using private household boats to access the CINMS.
2. Percents are the percent of the total economy of each county, or for all counties, the percent of regional totals for all seven counties. The percents are all less than one percent or fractions of a percent.

Significance. The use of the term "significant impact" is a highly charged term and is often misunderstood or purposely misused to marginalize a particular group. In socioeconomic impact analysis, we have to be very careful how and when we use this descriptor. The term "significant," can only be interpreted for each context of use.

There exist some administrative definitions of significance. Presidential Executive Order 12866 defines a significant impact for Federal Regulations as any impact of $100 million or more. When the impact of a Federal Regulation is expected to have impacts of $100 million or more, then the requirement is that the Federal agency proposing the regulation must conduct a benefit-cost analysis of the regulation. As we shall show below, none of the six alternatives analyzed here results in that level of impact.

Another Federal law (Magnuson-Stevens Fishery Conservation and Management Act, Section 303, a), specifies 10 National Standards. National Standard 9 deals with impacts on the fisheries, which are addressed in this report and National Standard 8, which deals with impacts on fishing communities (not addressed in this report). Although the Act did not explicitly define a fishing community, several court cases have resulted in the National Marine Fisheries Service (NMFS) adoption of criteria to define communities and further fishing communities. Census Designated Places or cities define communities. Counties are considered too large for identifying communities. Census Designated Places or CDPs are officially recognized by the U.S. Bureau of the Census and have Federal Information Processing System (FIPS) codes for organizing socioeconomic information on CDPs or cities, as do counties and states. Fishing communities are CDPs or cities that depend directly or indirectly on the recreational and commercial fisheries for at least 20 percent of either their income or employment, or that 20 percent of the

population living in the community is directly or indirectly dependent on the fisheries. Once a community is identified as a "fishing community", National Standard 8 requires a detailed Social Impact Analysis (SIA). Impacts of five (5) percent of a community's income or employment are considered significant by NMFS. NMFS currently recommends following the guidelines issued by the International Association for Impact Assessment (1993) for SIAs. The information included in this report can be used to assess the need for an SIA.

In Tables 1.3 and 1.4, we show our estimates for personal income and employment generated from each activity in each county. Directly under each estimate is the percent of the total personal income or employment that a given activity accounts for in each county's economy. Across all activities, we show that our estimate of personal income impact of about $172 million was less than four one-hundredths of one percent (a small fraction of one percent) of the entire seven-county area. If all the activities in the CINMS were prohibited, it would not have significant impact on the total economy of the seven-county region. Here the use of significant impact is limited to the relationship between the activities in the entire economy of the region. If all the activities in the CINMS were prohibited, a benefit-cost analysis would be required.

Table 1.4 Local/Regional Economic Dependence on CINMS: Employment, 1999

County	Commercial Fishing	Consumptive Recreation	Total Consumptive Activities	Nonconsumptive Recreation[1]	All Activities
Monterey	570	0	570	0	570
%[2]	0.2606	0	0.2606	0	0.2606
San Luis Obispo	5	0	5	0	5
%	0.0036	0	0.0036	0	0.0036
Santa Barbara	488	62	550	67	617
%	0.1999	0.0254	0.2252	0.0274	0.2527
Ventura	2,410	579	2,989	110	3,099
%	0.6167	0.1482	0.7649	0.0281	0.7930
Los Angeles	488	13	501	2	503
%	0.0091	0.0002	0.0093	0.00004	0.0094
Orange	0	0	0	0	0
%	0.0000	0	0.0000	0	0.0000
San Diego	94	0	94	0	94
%	0.0056	0	0.0056	0	0.0056
All Counties	4,056	654	4,710	179	4,889
%	0.0413	0.0067	0.0479	0.0018	0.0498

1. Nonconsumptive recreation and All Activities are under estimated because no information was available for nonconsumptive recreation using private household boats to access the CINMS.
2. Percents are the percent of the total economy of each county, or for all counties, the percent of regional totals for all seven counties. The percents are all less than one percent or fractions of a percent.

A review of Tables 1.3 and 1.4 will reveal that the inclusion of Orange County may bias our assessment of the significance, since Orange County has a relatively large economy and very little activity in the CINMS impacts Orange County. However, each of the seven counties in the seven-county impact area is not significantly impacted by the activities in the CINMS. The highest impact is in Ventura County, which depends on about eight-tenths of one percent of its employment on activities in the CINMS.

From Tables 1.3 and 1.4, we can conclude that any impacts from marine reserves, which would only impact some fraction of the activities in the CINMS, that the economic impact in any local economy will not be significant. By this we mean to limit this conclusion as to the total incomes, employment and tax revenues in each county. Thus we predict that there will be ***no significant macroeconomic or fiscal impacts from marine reserves in the CINMS.***

As we have demonstrated above, the limitation of activities in the CINMS from marine reserves will not have significant impacts on the local economies. However, that is the limit of our abilities to make

judgements about the significance of socioeconomic impacts. We are ***not able to conclude that there would or wouldn't be significant impacts on certain individuals or groups.*** Certainly if you are among those who are impacted it is significant to you. We have no basis for judging significance in this context. All we can do is provide our best estimates of what we think are the extent of potential impacts. We make no judgements as to their significance.

Conclusions about the County Economies. Much of the impacts from activities in the CINMS take place in Ventura and Santa Barbara counties. Appendix A includes a shortened version of a paper we produced in June 2000 entitled "A Socioeconomic Overview of the Santa Barbara and Ventura Counties as it relates to Marine Related Industries and Activities". This report was developed at the beginning of the CINMS management plan revision process. Some of the data has been updated and changed as a result of further research. The original report is still posted in portable document format (downloadable pdf) on the CINMS World Wide Web site (http://www.cinms.noaa.gov/Semembreserves.html).

Appendix A provides much greater detail on the populations and economies of Ventura and Santa Barbara counties. Generally, these areas can be characterized as growing, dynamic and diverse areas with both healthy and diverse economies.

Commercial Fishing Industry and Kelp Harvesting

Here we provide a baseline socioeconomic profile of the commercial fishing industry and kelp harvesting/processing. Figure 3 summarizes the economic impact model used for the commercial fisheries in the CINMS.

Economic Impact Model. The top box in Figure 3 refers to the maps of ex vessel value (revenue received by fishermen) by species/species group. We compiled commercial fishing catch data from 1988 – 1999 by species and California Department of Fish and Game (CDFG) 10-by-10 mile blocks. The definition of blocks most closely approximating the CINMS was comprised of 22 CDFG blocks (see Appendix C for a map showing the blocks used for defining the CINMS). There are many species and from previous reports and our own judgement, we formed 27 species groups. Some such as herring roe, surf perch, grenadiers and octopus that were prominently noted in previous reports did not prove to be very significant. The definitions of the species groups are also included in Appendix C.

Table 1.5 shows the ex vessel value of the commercial fisheries in the CINMS for years 1999 and for the average of years 1996-1999. In 1999, the top 14 species/species groups accounted for 99.7 percent of the commercial landings from the CINMS and for the years 1996-1999, the top 14 accounted for 98.69 percent of the commercial landings from the CINMS. Abalone fishing was halted in 1997, so for the years 1996-1999, the top 14, excluding Abalone accounted for 99.21 percent of the value of commercial landings.

The top 14 species/species groups are included in our analyses for the commercial fisheries along with Kelp. Kelp was treated differently because only one company harvests it, ISP Alginates located in San Diego, California. Harvested value equivalent to ex vessel value was not available. Instead, ISP Alginates supplied us with the processed value of kelp (1996-1999 average of $5,991,367). We constructed a separate economic impact model for kelp with the help of Dale Glantz of ISP Alginates. All the economic impact from kelp takes place in San Diego County where it is landed and processed.

After reviewing the trends in CINMS catch and value from 1988 – 1999, we decided that the average of years 1996-1999 would be the most representative estimate for extrapolating future impacts. The trends in catch, value of catch and prices for CINMS and for the State of California are included in Appendix C. One can see in Table 1.5 that squid is the dominant fishery in the CINMS as well as the State of California. But squid catch is sensitive to El Nino events. In 1998, squid catch plummeted, then rebounded to a record catch in 1999. The 1996-1999 average accounts for this time variability.

Figure 3. Economic Impact Model for Commercial Fisheries in the CINMS

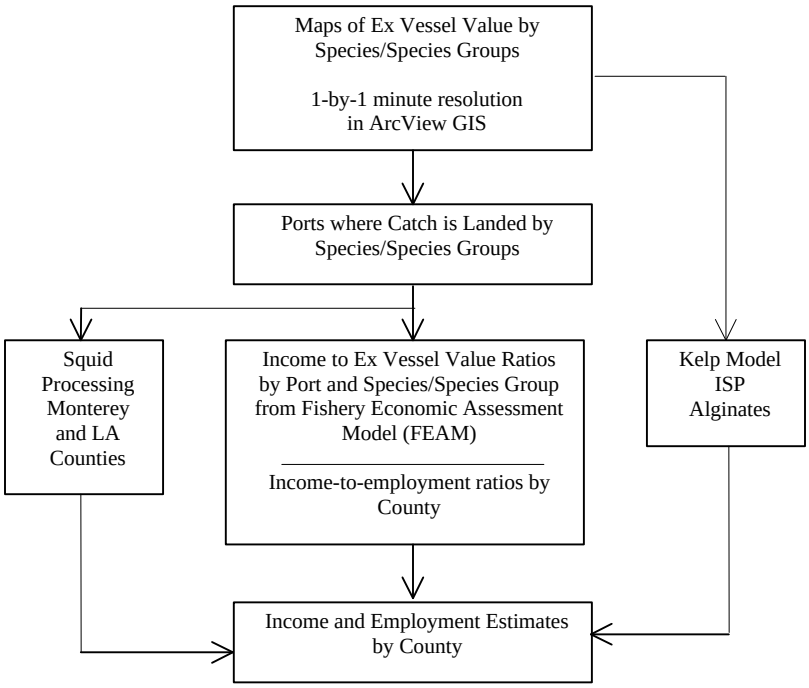


Table 1.5 Commercial Fishing Ex Vessel Value for the CDFG 22 Block Definition of the CINMS

Species/Species Group	1999 Value $	Percent	Avg. 1996-1999 Value $	Percent	Rank 1999	Rank 1996-1999
Squid	26,558,813	72.31	13,046,664	58.21	1	1
Urchins	5,963,876	16.24	5,265,233	23.49	2	2
Spiny Lobster	952,991	2.59	922,098	4.11	3	3
Prawn	743,159	2.02	703,186	3.14	4	4
Rockfishes	549,446	1.50	549,319	2.45	5	5
Anchovy & Sardines [1]	548,944	1.49	234,367	1.05	6	9
Flatfish	324,685	0.88	183,871	0.82	7	10
Crab	313,289	0.85	343,664	1.53	8	6
Sea Cucumbers	267,842	0.73	167,700	0.75	9	12
CA Sheepshead	153,147	0.42	235,928	1.05	10	7
Sculpin&Bass	88,547	0.24	60,327	0.27	11	14
Mackerel [1]	59,921	0.16	67,119	0.30	12	13
Tuna	53,694	0.15	305,665	1.36	13	8
Shark	41,638	0.11	34,751	0.16	14	16
total included in analyses	**36,619,992**	**99.70**	**22,119,892**	**98.69**		
Abalone	47	0.00	178,027	0.79	25	11
Swordfish	21,472	0.06	39,090	0.17	17	15
Roundfish	37,318	0.10	33,262	0.15	15	17
Other	23,728	0.06	22,990	0.10	16	18
Yellowtail	14,832	0.04	6,891	0.03	18	19
Shrimp	1,057	0.00	5,813	0.03	22	20
Mussels and Snails	7,745	0.02	4,694	0.02	19	21
Salmon	1,407	0.00	1,411	0.01	21	22
Rays & Skates	2,283	0.01	1,164	0.01	20	23
Surf Perch	447	0.00	695	0.00	23	24
Grenadiers	0	0.00	211	0.00	26	25
Octopus	169	0.00	196	0.00	24	26
total not included in analyses	**110,505**	**0.30**	**294,444**	**1.31**		
Total All Species [2]	**36,730,497**	**100.00**	**22,414,336**	**100.00**		
Total, excluding Abalone	**36,730,450**	**99.99987**	**22,236,309**	**99.21**		

1. Anchovy & Sardine and Mackerel are combined in the Wetfish map.
2. Kelp is not included here because it is measured differently. The 1996-1999 average for Kelp used in our analysis is $5,991,367 and represents the processed value of kelp from ISP Alginates.

For the top 14 species/species groups included in our analyses, we hired two contractors, Dr. Craig Barilotti and Dr. Caroline Pomeroy, to gather socioeconomic data on the fishermen who fish in the CINMS and their distribution of catch at the 1-by-1 nautical mile unit of resolution within the boundaries of the CINMS. We use the control totals from CDFG and PacFIN trip ticket information for total catch. The report detailing our data collection and estimation methods is included here as Appendix B. The ex vessel value landing data is organized in a geographic information system called ArcView. We built an economic model using the spreadsheet software Microsoft Excel.

The commercial fishery economic impact model translates ex vessel value of landings into total income and employment impacts on the local economies. This is done by first using the distributions of catch by species/species group from the CINMS and port where landed (see Appendix C for the port/species distributions). Then multipliers are used that translate ex vessel value of landings by species/species groups at a given port to total income generated in the local county economy where the port where the catch was landed is located. These multipliers were obtained from the Fishery Economic Assessment Model (FEAM). Two economists under contract to the Pacific Fishery Management Council developed FEAM. FEAM is based on Input-Output models detailing inter-industry relationships. FEAM was designed for regional economic analysis and processing of the landings are assumed to take place within the county where the port is located. The assumption is that for regional analysis the cross-county effects cancel each other out.

For squid, the socioeconomic panel decided that the squid processing had effects large enough to warrant special treatment. Multipliers from FEAM were adjusted downwards for ports where squid was sent to another county for processing. The 1996-1999 average distributions for processing squid from port to county of processing were used. Generally, multipliers were reduced by 1.5 (if multiplier was 4.5 it was reduced to 3.0) at the port where landed and thus the impact in the county where landed and increased by 1.5 in the county where processed. Monterey and Los Angeles counties were the primary places for processing squid. Squid accounts for the relatively large income impacts estimated for Monterey and Los Angeles counties even though very little squid is landed in Monterey County.

The income-to-ex vessel value multipliers from FEAM are not the standard economic multipliers one sees in most local and regional economic analysis. However, the multipliers are derived from the standard economic multipliers in the input-output models for each county. FEAM was used to estimate the income generated from ex vessel value reported at each port for each species/species group. We took the average of the income-to-ex vessel value for years 1994 -1998 and applied these multipliers to the ex vessel value from the CINMS at each port. Table 1.6 provides the Ventura County Port multipliers as an example. Full details are available from the authors upon request.

Table 1.6 Income-to-Ex Vessel Value Multipliers: Ventura Harbor

Species/Species Groups	Income-to-Ex Vessel Multipliers
Squid [1]	3.2
Urchins	2.1
Spiny Lobsters	2.0
Rockfishes	1.6
Prawn	2.0
Crab	2.8
Wetfish	1.6
CA Sheepshead	1.6
Flatfish	1.6
Sculpin & Bass	1.6
Tuna	1.7
Shark	2.3

1. For squid, 24.45 percent was trucked to Monterey County for Processing and 64.98 percent was trucked to Los Angeles County for processing. The remaining 10.57 percent was Processed in Ventura County. The multiplier for squid is adjusted downwards by 1.5 to account for processing in Monterey and Los Angeles counties.

Employment impacts are estimated by dividing the total income estimated in each county by the ratio of total income to employment in each county. Total income and total employment impacts fully account for all the multiplier impacts. Because of the FEAM assumptions about processing, the results are more reliable at the total region level.

Baseline 1996-1999 Economic Impacts. Table 1.7 summarizes the baseline 1996-1999 annual averages for total income and employment generated from commercial fishing and kelp from the CINMS. It is especially important to note the differences in Table 1.7 from those presented earlier in Table 1.3. As with the average ex vessel value of landings, the annual average total income and employment impacts for years 1996-1999 are much smaller than the impacts for 1999. Again, most of the difference is explained by the record year for squid in 1999. The 1996-1999 average adjusts for the 1997-1998 El Nino (bust year) and the 1999 record year. All Step 1 analyses of alternatives presented in Chapter 2 are based on the 1996-1999 annual averages. Percents of a user group ex vessel revenue or total income and employment impacted are percents of these 1996-1999 baselines.

Table 1.7 Economic Impact of Commercial Fishing and Kelp Harvesting: Baseline Annual Average 1996-1999

County	Total Income	Employment
Monterey	$9,488,934	280
San Luis Obispo	$113,547	4
Santa Barbara	$13,352,514	433
Ventura	$40,397,319	1,229
Los Angeles	$10,043,552	266
Orange	$583	0
San Diego	$9,517,101	93
All Counties	$82,913,552	2,307

Socioeconomic Profiles of Fishermen. Two separate samples of fishermen were surveyed (details are included in Appendix B). The first sample is sometimes referred to as the Pomeroy Sample and includes fishermen in the squid/wetfish fishery. The second sample is sometimes referred to as the Barilotti Sample and includes fishermen in all other fisheries, except squid and wetfish. It is important to note that both samples can be characterized as being involved in multi-species fisheries. Tables 1.8, 1.9 and 1.10 provide socioeconomic profiles for both samples of fishermen and demonstrate that each sample depends on multiple species. Often the multiple species dependence is seasonal and important in supplying income flows over the course of a year. Small percents of dependence on a particular species/species group may involve a week or a month of income at a time when the opportunity to catch the main species/species groups fished are not available and participation in other fisheries are the only source of income. In our Step 1 analyses in Chapter 2, we take this kind of dependence into account. Here we provide a baseline profile of fishermen of the CINMS and compare them with some profiles of fishermen obtained from a study of Tri-County fishermen (e.g., Santa Barbara, Ventura and San Luis Obispo counties).

Table 1.8 Commercial Fishing: Multi-Species Fishery, Barilotti Sample

	N	Mean	Range
Number of Species/Species Groups Caught in CINMS	56	2.59	1 - 13
	Number	Percent	Cumulative Percent
	1	48.2	48.2
	2	25.0	73.2
	3 - 4	12.5	85.7
	5	5.4	91.1
	GT 5	8.9	100.0
Number of Species/Species Groups Caught Anywhere	N	Mean	Range
	58	3.41	1 - 14
	Number	Percent	Cumulative Percent
	1	39.7	39.7
	2	22.4	62.1
	3 - 4	12.0	74.1
	5	6.9	81.0
	GT 5	19.0	100.0

Table 1.9 Socioeconomic Profiles: Commercial Fishermen, Barilotti Sample

	N	Mean	Range
EXPERIENCE			
Years Commercial Fishing	58	20.16	8 - 32
Years Fishing IN CINMS	57	19.11	4 - 32
AGE	58	44.83	30 - 64
EDUCATION			
Years of Schooling	57	12.89	0 - 17
DEPENDENCY ON FISHING			
Percent of 1999 Income from Fishing	57	90.02	10 - 100
Percent of 1999 Household Income from Fishing	57	83.49	10 - 100
Percent of Fishing Outside CINMS	55	17.71	0 - 97
Percent of 1999 Fishing Revenue from CINMS			
Urchin	40	73.76	0 - 100
Spiny Lobster	10	58.39	0 - 100
Sea Cucumbers	13	71.88	0 - 100
Rockfish	17	20.42	0 - 100
Crab	17	35.85	0 - 100
Flatfish	11	10.47	0 - 52.16
CA Sheepshead	16	49.27	0 - 100
Sculpin & Bass	6	10.02	0 - 37.74
Shark	8	4.72	0 - 18.93
Other (those not listed above)	17	52.92	0 - 100
All Species/Species Groups	**57**	**71.46**	**2.8 - 100**
PEOPLE DIRECTLY EMPLOYED AND FAMILY MEMBERS SUPPORTED			
Number of Crew	55	1.36	0 - 11
Number of Crew with Skipper's Licenses	55	1.29	0 - 11
Number of Family Members Supported by Captains/Owners, not including self	58	2.1	0 - 5
OWNERSHIP/INVESTMENT			
Boat Ownership (Percent Yes)	88.3		
Replacement Value of Boat	57	120,930	0 - 1,400,000
Replacement Value of Electronic Equipment	53	11,126	0 - 90,000
Replacement Value of Fishing/Diving Gear	54	16,231	1,000 - 110,000
Replacement Value Boat, including Equipment and Gear	50	128,104	1,500 - 660,000

Table 1.9 (continued)

RESIDENCE/MAIN LANDING PORT	Percent
State	
California	100
City	
Arroyo Grande	1.8
Atascadero	3.5
Carpenteria	5.3
Goleta	3.5
La Conchita	1.8
Morro Bay	1.8
Newbury Park	1.8
Ojai	1.8
Oxnard	7.0
Oak View	1.8
San Pedro	1.8
Santa Barbara	52.6
Simi Valley	1.8
Tarzana	1.8
Ventura	12.3
Main Landing Port	
Channel Islands Harbor	13.8
Santa Barbara	63.8
San Pedro	1.7
Ventura Harbor	15.5
Multiple	5.1

The commercial fishermen other than squid/wetfish or the Barilotti Sample included 59 fishermen. The squid/wetfish or Pomeroy Sample included 29 purse seine boat's skippers and 8 light boat's skippers. Profiles of purse seine boat's skippers and light boat's skippers are presented separately. Not every fisherman supplied complete information so sample size (N) or the number responding to each item is reported in Tables 1.8, 1.9 and 1.10. Measurements included: 1) Experience (Years of Commercial Fishing and Years Commercial Fishing in the CINMS and Age of the fisherman interviewed), 2) Education (Years of Schooling of the fisherman interviewed), 3) Dependency on Fishing (Percent of Income from Fishing, Percent of Fishing Revenue from CINMS and Number of Crew and Family Members Supported by directly by the fishing operation), 4) Ownership/Investment (Boat Ownership and Replacement Value of Boats and Equipment), 5) Residence (State and City) and 6) Ports Used (Home Port, Main tie-up Port, and Main Landing Port). More detail was available from the squid/wetfish fishermen (Pomeroy Sample) than the other commercial fishermen (Barilotti Sample).

Although our samples of commercial fishermen accounted for 79 percent of the total ex vessel of catch from the CINMS, they represent only 13 percent of the total number of fishermen reporting catch in the CINMS. In 1999, there were 737 fishing operations reporting some catch from the CINMS. Nineteen (19) percent accounted for 82 percent of the total ex vessel value, with each of these operations receiving at least $50,000 per year in ex vessel value (141 operations). Almost 64 percent of fishing operations (469) received less than $20,000 per year and accounted for only about 6 percent of total ex vessel value from the CINMS, and 23 percent (170 operations) earned less than $1,000, which was 0.20 percent of the total ex vessel value from the CINMS (see Appendix C for details). For analyzing catch distributions, we believe the information is highly reliable. We do not think, however, that the profiles of the sample fishermen are "representative" samples of the commercial fishing population and our profiles information cannot be extrapolated to population totals. Our sample does provide a broad range of types of fishermen (who happen to catch most of the fish) and can be used for assessing adverse impacts and difficulties of adapting to change[2].

Table 1.10 Socioeconomic Profiles: Squid/Wetfish Fishermen, Pomeroy Sample

	Purse Seine Boats		Light Boats	
EXPERIENCE				
	Mean	Range	Mean	Range
Years Commercial Fishing	26.28	9 - 56	19.12	8 - 28
Years Fishing in CINMS	17.00	4 - 45	13.62	6 - 27
AGE	44.18	29 - 61	37.00	26 - 44
EDUCATION				
Years of Schooling	11.78	0 - 16	12.56	10 - 15.5
DEPENDENCY ON FISHING				
Percent of 1999 Income				
From CINMS Squid	70.34	32 - 100	86.90	65 - 100
From Other CINMS Fisheries	3.88	0 - 25	6.62	0 - 25
From Fisheries Outside CINMS	23.33	0 - 60	5.84	0 - 27
From Non Fishing Work	0.38	0 - 10	0.00	0
From Investments	2.07	0 - 17	0.63	0 - 5
Percent of Average Annual 1996-99 Fishing Revenue1				
Squid fishing in CINMS/All Squid Fishing	71.07	25.39 - 98.47	14.63	0.96 - 44.44
Wetfish in CINMS/All Wetfish Fishing	22.10	0 - 100	3.77	0 - 15.08
Tuna in CINMS/All Tuna Fishing	3.79	0 - 100	14.59	0 - 25.73
Other Finfish in CINMS/All Other Finfishing	6.90	0 - 100	38.67	0 - 70.72
Shellfish in CINMS/All Shellfishing	3.45	0 - 100	41.97	0 - 100
All CINMS Fishing/All Fishing	60.93	11.95 - 94.60	13.71	5.20 - 22.29
People Directly Employed and Family Members Supported				
Number of Crew on Main Vessel	5.00	3 - 9	0.875	0 - 2
Number of Relief Skippers	0.31	0 - 1	0.375	0 - 1
Number of Captain/Owners Family Members, including self	3.64	1 - 6	2.75	1 - 5
Number of Family Members Supported by Crew, including crew	18.54	3 - 54	2.375	0 - 8
Total Supported, except Relief Skipper Family	22.12	5 - 59	5.5	2 - 12
OWNERSHIP/INVESTMENT				
Boat Ownership	***Percent***			
Sole Owner	27.6		25.0	
Owns with Other Family Member	44.8		12.5	
Owns with Partner	13.8		50.0	
Market owns	3.4		0.0	
Other owns	10.3		12.5	
	Mean	Range	Mean	Range
Length of Ownership	19.04	4 - 37	11.19	0 - 23
Number of Boats Owned	0.86	0 - 3	0.88	0 - 3
Replacement Value of Main Boat, including all equipment	$778,793	75,000 - 2,000,000	$210,000	70,000 - 485,000
Replacement Value of All boats, including all equipment	$917,931	275,000 - 2,800,000	$272,500	120,000 - 600,000
RESIDENCE/HOME PORT/MAIN LANDING PORT	Percent		Percent	
Residence				
State				
California	93.1		100	
Washington	6.9		0	

Tri-County Fishermen. The socioeconomic panel obtained summary tables of information from a study done by Utah State University researchers (Ron Little and Joanna Endter-Wada) under contract to the U.S. Department of the Interior, Minerals Management Service. The Tri-county area includes San Luis Obispo, Santa Barbara, and Ventura counties. In 1996, the Utah State University researchers conducted a survey of 248 commercial fishermen who live in the Tri-County area. 95 of their 248 fishermen fished in the CINMS. 60 of the 96 fishermen in our samples lived in the Tri-county area. Very few of the squid/wetfish

fishermen from our samples lived in the Tri-County area. A comparative profile was constructed comparing some common measurements taken in our two studies (Table 1.11).

Table 1.11 Comparative Profiles: Tri-County Fishermen [1]

	All Tri-County Fishermen [2]	Tri-County Fishermen that Fish in CINMS	Tri-County Fishermen NOAA Samples [3]
EXPERIENCE			
Years Commercial Fishing	Percent	Percent	Percent
1 to 10	26.1	27.4	6.3
11 to 20	32.2	39.0	36.1
21 to 30	29.8	26.3	41.3
31 to 40	6.2	6.3	6.3
Greater than 40	5.7	1.0	0.0
N	245	95	63
Mean	N/A	17.53	20.75
AGE	Percent	Percent	Percent
25 to 29	3.0	5.4	0.0
30 to 39	27.2	36.9	25.0
40 to 49	37.5	36.9	43.8
50 to 59	20.4	15.3	29.6
60 to 69	7.3	3.3	1.6
Greater than 69	4.8	2.2	0.0
N	235	92	60
Mean	N/A	42.98	45.28
EDUCATION			
Years of Schooling	Percent	Percent	Percent
Less than 12	8.1	7.6	12.7
12	24.6	21.7	30.2
Greater than 12	67.3	70.7	57.1
N	236	92	63
DEPENDENCY ON FISHING			
Percent of Income from Fishing	Percent	Percent	Percent
0 to 19	19.5	10.8	0.0
10 to 29	12.2	8.7	1.6
30 to 49	6.1	5.4	4.8
50 to 69	11.3	15.1	6.4
70 to 89	12.6	12.9	8.0
90 to 99	10.8	12.9	9.6
100	27.7	34.3	69.8
N	231	93	63

Table 1.11 (continued)

	All Tri-County Fishermen [2]	Tri-County Fishermen that Fish in CINMS	Tri-County Fishermen NOAA Samples [3]
Number of Crew	Percent	Percent	Percent
0	20.8	12.2	13.1
1	43.3	42.2	55.7
2	27.3	35.6	16.4
3 to 4	7.8	8.9	13.2
5 to 6	0.8	1.1	0
Greater than 6	0	0	1.6
N	231	90	61
Mean	N/A	1.48	1.52
BOAT OWNERSHIP	Percent	Percent	Percent
Owner	95.7	95.7	84.3
Non Owner	4.3	4.3	15.7
N	237	93	57
RESIDENCE/HOME PORT			
County of Residence	Percent	Percent	Percent
Ventura	27.7	47.3	39.1
Santa Barbara	32.8	44.8	54.7
San Luis Obispo	39.5	8.8	6.3
N	238	91	64
Home Port	Percent	Percent	Percent
Port Hueneme	2.5	2.2	7.8
Channel Islands/Oxnard	16.9	29.3	15.6
Ventura Harbor	9.1	16.3	14.1
Santa Barbara	30.9	48.9	57.8
Port San Luis/Avila Beach	15.6	1.1	0
Morro Bay	23	2.2	0
Other	2	0	4.7
N	243	92	64

1. Tri-County area is San Luis Obispo, Santa Barbara and Ventura Counties.
2. All Tri-County Fishermen and Tri-County Fishermen that Fish in CINMS are from a study funded by the U.S. Dept. of Interior, Minerals Management Service to Utah State University researchers Ron Little and Joanna Endter-Wada.
3. NOAA Samples are the ones derived from contracts with Dr. Craig Barilotti and Dr. Caroline Pomeroy.

No difference was found between the two studies samples for Experience, Age, or Number of Crew. Our samples had lower levels of education, a lower percentage of boat ownership, a higher proportion of our samples lived in Santa Barbara and also reported Santa Barbara as their Home Port, and our sample was more dependent on fishing for their income.

Consumer's Surplus. In the section above that discussed the benefits and costs to each user group, we discussed the possibility of there being losses to consumers if the supply of commercial seafood products were reduced enough to have impacts on prices to consumers or a gain to consumers, if marine reserves resulted in increased supplies and lower prices to consumers. To estimate consumer's surplus requires access to econometric demand and supply models for each of the fisheries. We were not able to find any such research for California seafood products, except urchins (see Reynolds 1994). One problem with the

Reynolds paper was that all the information required to utilize the model was not included in the report. Therefore, we are not able to provide estimates of impacts on consumers from possible price changes.

Although we cannot estimate consumer's surplus, we can assess whether the amount of supply from the CINMS is a significant portion of total supply and therefore whether reductions in the supply might effect prices. Table 1.12 summarizes CINMS landings, U.S. landings, and U.S. Supply and the proportions of CINMS supply relative to that of the U.S., for eight of the species/species groups. The information is from the National Marine Fisheries Service for 1999. It appears that squid and urchins are the only species/species groups for which significant proportions of U.S. landings come from the CINMS. Eliminating the total catch from the CINMS might have impact on prices. However, squid and urchins are primarily sold in foreign markets, therefore the world supply is probably more relevant for determining whether supply from the CINMS would have price effects. The United Nations, Food and Agricultural Organization (FAO) reports a 1999 world commercial catch of squid of 3,373,463 metric tons or 7,438.486 million pounds. CINMS landings were only 2.15 percent of world supply and 1999 was a record year for squid in the CINMS. FAO also reports the 1999 world commercial catch of urchins of 118,750 metric tons or 261.844 million pounds. CINMS landings were 2.24 percent of world supply. Given the small proportions of world supply accounted for by CINMS squid and urchin catches, any changes in supply from marine reserves would not be expected to change prices to consumers and thus there are no likely impacts on consumer's surplus.

Table 1.12 Relative Supply of Selected CINMS Commercial Species, 1999

	Landings		Landings		Landings		Supply	
	CINMS	CINMS	U.S.	U.S.	CINMS/U.S.	CINMS/U.S.	U.S.	CINMS/U.S.
	1999	1999	1999	1999	1999	1999	1999	1999
Species/Species Group	(Millions lbs)	(Millions $)	(Millions lbs)	(Millions $)	% of lbs	% of $	(Millions lbs)	% of lbs
Squid	159.564	26.545	258.198	71.172	61.80	37.30	N/A	N/A
Urchins	5.855	5.969	33.55	35.647	17.45	16.74	N/A	N/A
Spiny Lobster	0.121	0.951	6.692	29.754	1.81	3.20	90.586	0.13
Prawn & Shrimp	0.178	0.726	304.173	560.501	0.06	0.13	1,083.60	0.01
Crab	0.247	0.313	458.307	521.237	0.05	0.06	N/A	N/A
Rockfishes	0.192	0.553	60.223	30.436	0.32	1.82	N/A	N/A
Flatfishes	0.121	0.324	411.548	214.642	0.03	0.15	N/A	N/A
Tuna	0.168	0.054	58.12	86.254	0.29	0.06	N/A	N/A

Sources: Current Fishery Statistics No. 2000, Fisheries of the United States, 2000. National Marine Fisheries Service and California Department of Fish and Game, Marine Fisheries Statistical Unit.

Economic Rent. Another measured listed as a possible benefit or cost was economic rent. To estimate economic rents requires detailed information on the costs and returns and investment by fishermen. Although both contractors sought to obtain this information, many fishermen were reluctant to reveal their full costs and earnings. This prevents us from evaluating the existence or extent of impact on economic rents.

In open access fisheries, economic rents are generally predicted to be dissipated by new entrants into the fishery (Smith, 1968)[3]. Entry stops when average cost per unit of catch equals the price per unit of catch and economic rents are eliminated (i.e., every fisherman is earning a normal return on investment). Some economists have noted certain conditions under which economic rents could exist even under open access conditions. Economic rents could exist if they were many fishermen but only one buyer (Worcester, 1969). The buyer would have monopoly power and could limit the amount of catch purchased from fishermen and claim all the economic rents. Under this condition, the fishermen are not earning economic rents, instead the buyer due to his monopoly position is able to capture all the economic rents. Another possibility is that certain contractual arrangements between buyers and fishermen could lead to them gaining some monopoly power. In the squid fishery, there might be relationships between light boats, purse seine boats and buyers such that they are able to gain some monopoly power (Pomeroy and Fitzsimmons 2001). The result may be what economists have called "inframarginal" rents (Johnson and Libecap, 1982). These are above normal returns to a few fishermen, who have these special relationships, which are not generally available to new entrants. These types of rents don't get dissipated with new entrants.

Lutz and Pendleton (2001) and Pendleton, Cai and Lutz (2001) have conducted studies of the San Pedro squid/wetfish fleet. Part of this fleet fish in the CINMS. The researchers were able to get more complete costs and earnings and investment information than we were able to get from the Pomeroy and Barilotti samples. The more complete information supported an assessment of economic rents in this fishery. Generally, the San Pedro squid/wetfish fleet seemed to be earning less than even normal returns to investment. The authors concluded that although there may not be sufficient evidence of biological overfishing for squid, there is some evidence of economic overfishing. This is a condition under which we might expect some exit from the industry[4].

All of the commercial fisheries in the CINMS can currently be characterized as open access fisheries. The squid/wetfish fishery is currently considering implementing a limited entry program in the current draft management plan. However, we have not seen any analysis of whether the limits would lead to economic rents in the fishery. We are not able to make any estimates of the impacts of marine reserves on economic rents.

Ethnographic Data Survey. At the beginning of the CINMS five-year management plan revision process, the CINMS conducted an ethnographic data survey (Kronman et al, 2000). Fifteen professional fishermen were interviewed about their opinions on the current status of various species and habitats, whether the status of the species and habitats have changed, environmental cycles observed, changes in climate, changes in equipment used for fishing, changes in regulations and when and/or if they affected their operations, changes in domestic and/or export markets for their products or changes in distributions of boats and fisheries and when and/or if these changes affected their operations.

The ethnographic information was used in developing some of our catch distributions (see Appendix B). We also expect to utilize some of the information in our Step 2 analyses.

Recreation Industry

Here we provide the baseline economic measures for the recreation industry. Recreation is divided into consumptive activities and nonconsumptive activities. Consumptive recreation includes recreational fishing from a charter/party boat, fishing from a private household/rental boat, consumptive diving from a charter/party boat and consumptive diving from a private household/rental boat. Nonconsumptive recreation includes nonconsumptive diving, whale watching, sailing and kayaking/sightseeing from for hire or charter/party boats. We were not able to find any information on nonconsumptive activities from private household/rental boats, so ***nonconsumptive uses are undercounted***. As mentioned in the section on benefits and costs, the consumptive recreation users potentially are both sufferers of costs and well as beneficiaries of marine reserves under various conditions. Nonconsumptive recreationists are potential beneficiaries of marine reserves. Because nonconsumptive users accessing CINMS from private household/rental boats are not counted, nonconsumptive benefits of marine reserves are underestimated. 1999 is the baseline year used for extrapolating future impacts.

In our previous assessment of recreational fishing (Leeworthy and Wiley, 2000), we had summarized information available for years 1993 to 1998 from the National Marine Fisheries Service, Marine Fishing Statistics Survey (MRFSS). MRFSS data was showing a downward trend in fishing trips and catch for Southern California over this period. Total trips had declined 26.4 percent. For the top 20 species, in terms of total number of fish caught, 10 had downward trends, 7 had no trend and 3 had upward trends. These trends were contrasted with the trends between 1991 and 1996, for all of California, based on the U.S. Fish and Wildlife Survey of Fishing, Hunting and Wildlife Associated Recreation (USFWS, 1991 and 1996). This latter survey showed a slight decrease in the number of recreational anglers (-0.76 percent), but an increase in the number of angler days (27.88 percent). Although the definitions of the populations covered are different between the surveys, we were not able to reconcile the differences in trends because the MRFSS Northern California data also showed a downward trend.

Table 1.13 Number of Marine Recreational Fishing Trips in Southern California: 1993 - 2000 (thousands)

Year	Total	Private/ Rental Boat	Charter/ Party Boat	Shore
1993	4,037	1,625	1,174	1,238
1994	4,749	1,932	1,201	1,616
1995	4,301	1,701	1,129	1,471
1996	3,768	1,478	889	1,401
1997	3,232	1,275	788	1,169
1998	2,973	1,325	674	974
1999	2,437	1,019	617	801
2000	3,782	1,755	956	1,071
Percent Change 1993 - 1999				
	-39.6	-37.3	-47.4	-35.3
Percent Change 1993 - 2000				
	-6.3	8.0	-18.6	-13.5

Source: National Marine Fisheries Service, Marine Recreational Fisheries Statistics Survey (MRFSS) (http://www.st.nmfs.gov/st1)

In reviewing the list of the top 20 recreational species from our original table, we have noted that many species mentioned in major saltwater fishing magazines over the past couple of years were missing from the list of top 20 species. In addition, some information from the ethnographic data survey (Kronman et al, 2000) about the gill net restrictions and their impacts on certain species led us to investigate whether what we were reading about would show up in the MRFSS updated information. We were able to update the MRFSS information for 1999 and 2000 (Table 1.14). In 1999, trips continued on their downward trend, but the top 20 species for catch were starting to reveal some of the changes we had read about. Species like California Halibut, White Seabass, Pacific Barracuda and Yellowtail, which were not among the top 20 species between 1993 and 1998, were now moving up into the top 20 (Yellowtail actually ranked 21). In 2000, the number of trips ended the downward trend in total trips and across all boat modes and total catch increased as well. The number of trips increased dramatically between 1999 and 2000 (55.19%). The number of trips rebounded to almost their 1996 level. Overall, the trend in trips is still down from the 1993 level (-6.3%).

The top 20 species also changed fairly dramatically (Table 1.15). In 1999 and 2000, all the rockfish species previously among the top 20 between 1993 and 1998 dropped out of the top 20, except Vermillion Rockfish and Bocaccio. Vermillion Rockfish were ranked 13th in 1999 and 17th in 2000 and Bocaccio was ranked number 19 in 1999 and 21 in 2000. Species ranked number 11 to 20 in 1993 were all out of the top 20 in 2000, even though only three of theses species showed downward trends in catch between 1993 and 1998.

Table 1.14 Summary of Trends in Marine Recreational Catch in Southern California: 1993 - 1998

Ranking 1993	Ranking 1998	Species	Number	Mean Length
1	1	Chub Mackerel	down	no trend
2	2	Kelp Bass	down	no trend
3	3	Barred Sand Bass	down	no trend
4	5	White Croaker	down	no trend
5	6	Pacific Bonito	down	up
6	4	Barred Surf Perch	up	up
7	7	Vermillion Rockfish	down	no trend
8	13	Bocaccio	down	no trend
9	8	Pacific Sanddab	no trend	no trend
10	9	California Sheepshead	no trend	no trend
11	18	Chilipepper Rockfish	down	no trend
12	11	Copper Rockfish	no trend	no trend
13	10	Yellowfin Tuna	no trend	down
14	15	Lingcod	no trend	up
15	14	Dolphin	no trend	up
16	17	Brown Rockfish	down	no trend
17	16	Gopher Rockfish	up	no trend
18	12	Blue Rockfish	no trend	no trend
19	20	Canary Rockfish	down	up
20	19	Yellowtail Rockfish	up	up

Source: National Marine Fisheries Service, Marine Recreational Fisheries Statistics Survey (MRFSS) (http://www.st.nmfs.gov/st1)

Table 1.15 Changes in Top 20 Species in Marine Recreational Catch in Southern California, 2000

Ranking 1999	Ranking 2000	Species
2	1	Barred Sand Bass
4	2	Kelp Bass
1	3	Chub Mackerel
5	4	**California Halibut** [1]
3	5	**Pacific Barracuda**
6	6	White Croaker
12	7	**Spotted Sand Bass**
15	8	Pacific Sanddab
7	9	**California Scorpionfish**
10	10	**Ocean Whitefish**
8	11	California Lizardfish
21	12	**Yellowtail**
17	13	**White Sea Bass**
16	14	**Jacksmelt**
14	15	**Queenfish**
-	16	Pacific Bonito
13	17	Vermillion Rockfish
-	18	Yellowfin Tuna
-	19	**Shovelnose Guitarfish**
18	20	California Sheepshead

1. Species in bold were not among the top 20 1993 through 1998.
Source: National Marine Fisheries Service, Marine Recreational Fisheries Statistics Survey (MRFSS) (http://www.st.nmfs.gov/st1)

The confusing trends present a problem in choosing a baseline for extrapolating about future possible impacts. If the downward trends continue, then using the 1999 baseline estimates would overstate future impacts. If the trends were to start on an increasing path, then using the 1999 baseline estimates would understate impacts. One year of information is not enough to declare a reversal of trends, so we believe our use of baseline 1999 for extrapolating about future impacts is the most reasonable choice.

Economic Impact and Valuation Model. Figure 4 illustrates the overall steps of the economic impact and valuation model for the recreation industry in the CINMS. The model starts with the estimates of person-days of activity for each of the consumptive and nonconsumptive creation activities for year 1999. The person-days are mapped in 1-by-1 minute grid cells for the area within the CINMS. The mapped data is in a geographic information system using ArcView. All the maps are included in Appendix C. All data collection and estimation methods are described in Appendix B. The economic impact and valuation model is a set of linked spreadsheets using the software Microsoft Excel Version 97.

Definition: ***Person-day***: is one person undertaking an activity for any part of a day or a whole day.

In 1999, we estimated 437,908 total person-days of consumptive recreation in the CINMS (Table 1.16). Fishing from a private household boat was the top activity with over 214 thousand person-days (49% of the consumptive recreation activity) followed by about 159 thousand person-days of fishing from charter/party boats (36% of the consumptive recreation activity). Consumptive diving accounted for the remaining 15 percent of consumptive recreation activity. In 1999, 21 percent of the private household boat fishing and about 26 percent of the charter/party boat fishing in Southern California was done in the CINMS.

In 1999, we estimated 42,008 person-days of nonconsumptive recreation from “for hire” operations in the CINMS. As mentioned above, we were not able to estimate the amount of nonconsumptive recreation activity from private household boats. Whale Watching was the top nonconsumptive recreational activity with about 26 thousand person-days (62% of all nonconsumptive recreation activity) followed by nonconsumptive diving with almost 11 thousand person-days (26% of all nonconsumptive recreation activity). Sailing and Kayaking/Island Sightseeing accounted for the remaining 13 percent of nonconsumptive recreation activity.

Figure 4. Economic Impact Model and Valuation Model for the Recreation Industry in the CINMS

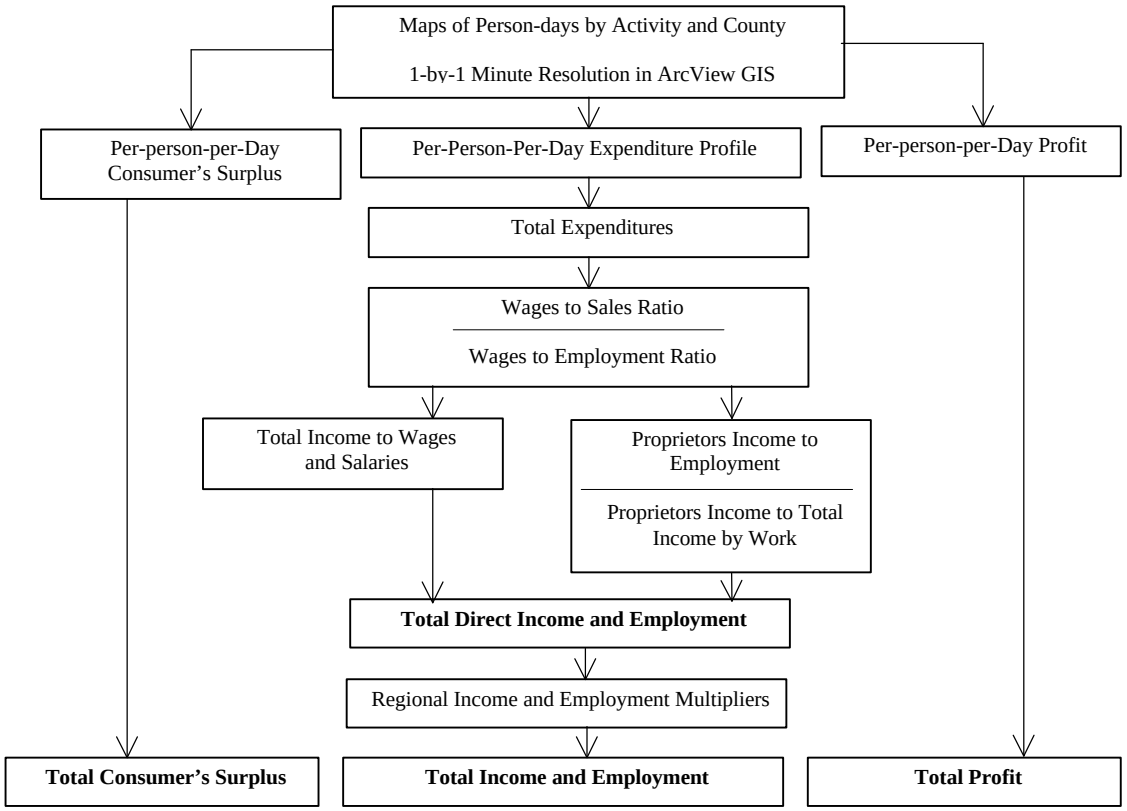


Table 1.16 Person-days of Recreation Activity in the CINMS, 1999

	Person-days (number)	Person-days (percent)
Consumptive Activities		
Charter/Party Boat Fishing	158,768	36%
Charter/Party Boat Consumptive Diving	17,935	4%
Private Boat Fishing	214,015	49%
Private Boat Consumptive Diving	47,190	11%
Total Consumptive	**437,908**	**100%**
Non-consumptive Activities		
Whale Watching	25,984	62%
Non-consumptive Diving	10,776	26%
Sailing	4,015	10%
Kayaking/Island Sightseeing	1,233	3%
Total Non-consumptive	**42,008**	**100%**

In 1999, the recreation industry included a total of 479,916 person-days of consumptive and nonconsumptive recreation. Consumptive recreation was 91.25 percent of all recreation activity in the CINMS. The "for hire" industry (51 charter/party boat/guide operations) accounted for almost 46 percent of all the person-days of recreation activity. This is important because the estimates of use from this industry were based on a census, not a sample, of all operators who operate in the CINMS (see Appendix B). Table 1.17 shows the total number of operators, person-days, revenues, costs and profits for this industry from

activities in the CINMS. It is important to note that adding up the number of operators across activities would add to more than 51 because some operators provide services for multiple activities.

Table 1.17 Charter/Party Operations in the CINMS, 1999

	Number of Operators[1]	Total Person-days	Total Revenue	Total Cost	Total Profit
Consumptive Activities					
Charter/Party Boat Fishing	18	158,768	$ 7,692,525	$ 7,316,229	$ 376,296
Charter/Party Boat Consumptive Diving	10	17,935	$ 1,089,839	$ 1,045,835	$ 44,004
Total Consumptive	**25**	**176,703**	**$ 8,782,364**	**$ 8,362,064**	**$ 420,300**
Non-consumptive Activities					
Whale Watching	8	25,984	$ 1,508,049	$ 1,498,828	$ 9,221
Non-consumptive Diving	7	10,776	$ 687,585	$ 641,272	$ 46,313
Sailing	8	4,015	$ 264,700	$ 246,618	$ 18,082
Kayaking/Island Sightseeing	4	1,233	$ 125,558	$ 116,337	$ 9,221
Total Non-consumptive	**26**	**42,008**	**$ 2,585,892**	**$ 2,503,055**	**$ 82,837**

1. The totals do not equal the sums of the individual activities because operators have customers who participate in more than one activity.

Expenditure Profiles. The next step in the economic impact model was the development of expenditure profiles for each recreation activity. During the MRWG process, we reviewed the literature and most of the studies we found were related to fishing in Southern California with one study for all of California party boat fishing (NMFS, 1980; Wegge, Hanemann and Strand, 1983; Rowe, Morey, and Ross, 1985; Hanemann, Wegge and Strand, 1991; and Thompson and Crooke, 1991). For consumptive diving and the non-consumptive activities, we supplemented this information with a visitor's study for Santa Barbara County (Santa Barbara County Conference & Visitors Bureau and Film Commission, 1999) for lodging and food and beverage expenditures, and a study on diving in Northwest, Florida for some dive related costs (Bell, Bonn and Leeworthy, 1998). Also, from the charter/party operations (Table 1.17), we derived the boat fee per person-day by county. From all this information we constructed expenditure profiles for these activities. Because we relied on mostly regional studies, the expenditure profiles do not differ by county except for the charter/party boat fees category.

The expenditure profiles used for charter/party boat and private boat fishing were taken from Gentner, Price and Steinback (2001). At the time we started the MRWG process in 1999, this expenditure report was not yet available. We knew the study was underway but were not aware the estimates were available to apply to the current six alternatives analyzed in this report. During the review process, we obtained the revised expenditure profile and re-ran the recreation model. Results in this report are based on the revised expenditure profile. See Appendix H for a discussion of issues brought up by the publication of the report sponsored by the American Sportfishing Association, including the use of this expenditure profile.

Table 1.18 shows the expenditure profiles we developed for each activity/boat mode. Low food, beverage and lodging costs would indicate a low percentage of users being overnight visitors or dominated by local users. In 1999, coastal residents accounted for 86.7% of charter/party boat trips and 96.86% of private household boat trips for fishing in Southern California (NMFS, MRFSS 1999). Not all the profiles we found had consistent categories, sometimes food and beverage was reported separately and sometimes they were aggregated together. When reported separately, we used the separated categories in the impact analysis.

The next step for calculating economic impact was to multiply the person-days of activity by the expenditures per person-day to get total direct sales impact. These direct sales estimates by expenditure category were mapped into the appropriate standard industry categories (SICs or NAICs under the new system) in the 1997 Economic Census of Business for each county. Direct sales estimates are translated into direct wages & salaries impact by multiplying the direct sales estimate by the appropriate wages-to-sales ratio specific to each category in each county. Estimated direct wages & salaries are then divided by the wages-to-employment ratios specific to each category in each county to get an estimate of the direct number of full and part-time employees directly supported.

Table 1.18 Expenditure Profiles for Recreation Activities in the CINMS, 1999

Expenditure	Fishing Charter/Party Boat	Fishing Private Boat	Diving Charter/Party Boat	Diving Private Boat
	Expenditures Per Person-day (1999 $)			
Boat Fees[1]	$47.62 - 60.74	n/a	$40.21 - 92.56	n/a
Boat Fuel	n/a	$ 12.74	n/a	$ 19.00
Food, Bev, Lodging	n/a	n/a	$82.00	$ 11.00
Food	$ 15.47	$ 7.60	n/a	n/a
Lodging	$ 8.65	$ 1.20	n/a	n/a
Transportation	n/a	n/a	$10.00	$ 9.00
Private Transportation	$ 16.64	$ 8.90	n/a	n/a
Public Transportation	$ 33.07	$ 1.89	n/a	n/a
Equipment/Equip. Rental	$ 6.01	$ 0.91	n/a	$ 5.00
Miscellaneous	n/a	n/a	$15.00	$ 10.50
Access/Boat Launch Fees	$ 1.18	$ 1.52	n/a	n/a
Air Refills	n/a	n/a	n/a	$ 7.00
Bait/Ice	$ 0.52	$ 6.77	n/a	$ 2.50
Total[2]	$129.16-$142.28	$ 41.53	$132.21-$184.56	$64.00

Expenditure	Whale Watching Charter/Party Boat	Non-consumptive Diving	Sailing Charter/Party Boat	Kayaking/Island Sightseeing
Lodging	$ 53.00	$ 53.00	$ 53.00	$ 53.00
Eating & Drinking	$ 29.00	$ 29.00	$ 29.00	$ 29.00
Transportation	$ 10.00	$ 10.00	$ 10.00	$ 10.00
Charter Boat Fee[1]	$53.43-60.19	$40.56-81.78	$61.99-177.61	$50.77-104.67
Miscellaneous	$ 15.00	$ 15.00	$ 15.00	$ 15.00
Total[2]	$160.43-167.19	$147.56-188.78	$168.99-284.61	$157.77-211.67

1. Boat fees used were actual by county and activity from the Kolstad survey. They are:

	SB	Ventura	LA
Charter/Party Boat Fishing	$ 60.74	$ 47.62	$ 59.95
Charter/Party Boat Diving	$ 40.21	$ 64.50	$ 92.56
Whale Watching	$ 53.43	$ 60.19	n/a
Non-Consumptive Diving	$ 40.56	$ 81.78	$ 48.48
Sailing	n/a	$ 61.99	$ 177.61
Kayaking/Island Sightseeing	$ 104.67	$ 50.77	n/a

2. The total varies because we used the actual charter/party boat fee by activity

Direct wages & salaries are then translated into total direct income by multiplying direct wages & salaries by the ratio of total income to wages & salaries income specific to each county. This adjustment accounts for proprietor's income. The ratio of proprietor's income to proprietor's employment is then used to derive proprietor's employment, which is then and added to wages & salaries employment to get total direct employment supported.

The final step is to calculate the multiplier impacts. Because we don't have estimates of the proportion of local residents to nonresidents in each activity in each county, we use a range of 2.0 to 2.5 for income multipliers and 1.5 to 2.0 for employment multipliers. These ranges of multipliers are consistent for economies in the impact area. Direct income and direct employment times the multipliers yields estimates of the total income impacts (Appendix C contains a printed version of the economic impact model for each activity and county). When we report only one estimate for income or employment, it is the upper range estimate, which we use for our ***maximum potential loss estimate*** in our Step 1 analyses of marine reserve alternatives.

Residents vs. Nonresidents. In local or regional economic impact analysis, the inclusion of resident spending impact is usually not done because it is already accounted for in the multiplier analyses of basic or export industries. Although data exists on the proportion of residents and nonresidents who access the Channel Islands, we did not have the proportion of residents of each county in the study area who accessed the Channel Islands from their county of residence. In this analysis we used the assumption that 50% of those who participated in recreation activities are residents of the county from which they accessed the Channel Islands. This assumption still most likely overstates the impacts from recreational uses given that 87% of charter/party boat fishing and 97% of private household/rental boat fishing in Southern California is done by coastal residents. But as we noted above, we don't have precise enough information on county of residence.

Import Substitution/Double Counting Economic Impact. Nonresident fishermen that bring new dollars into a county spend money, which is received by local businesses and they spend it on inputs of production, including wages and salaries for labor and a return to the business as profit. These workers and business owners spend a portion of their incomes in the local economy and thus the ripple or multiplier impacts. Some of the workers and business owners that received income through this multiplier impact will spend it locally on fishing trips in the CINMS. So this portion of resident spending would be double-counted.

We recognize that by including resident spending impacts, even only the direct impacts, does involve double counting. The reason for including it has to do with the "***import substitution***" argument. Import substitution means that the multiplier impact would be reduced from all basic or export industry spending, if the fishermen would substitute to fishing sites outside the local county. The multiplier impacts would be less without this spending. Local businesses have an incentive to keep this activity in the local area. So, this is another reason that supports our calling our Step 1 analysis estimates "maximum potential loss".

There is a gray area where resident direct impacts may not be double counting and which may not require the assumption of import substitution to count the impact. This would be the case of income earned from sources unrelated to work in the county of residence and spending. A good example is retirement and pension income. This source of income represents new dollars into the community and is thus a basic or export industry. Dollars of spending here have their own multiplier impacts that are not double counted. To the extent that local residents are spending from these sources of income for recreational fishing in the CINMS it is appropriate to include not only the direct impacts, but also the multiplier impacts of such spending.

As mentioned above, our Step 1 analyses simply add up the activity currently taking place within the proposed marine reserve areas and apply the assumption that all is lost. No account is taken of people's ability to substitute or relocate their fishing activities to other fishing sites. Under the preferred alternative, only 25% of the CINMS waters are included in the proposed network of marine reserves leaving 75% of the CINMS plus all the areas outside the CINMS for people to find other fishing sites. Additionally, there will be those who decided to participate in some other activity – these users would still be spending money in the local economy and therefore the income and employment dependent on this spending would not be lost. Thus, we would expect that our Step 1 estimates are overestimates of impact. We don't have a model to tell us how much substitution might take place, and what the net impact will be either in the short or long term. However, some substitution is likely, and to the extent people are able to find suitable substitute fishing sites, this will lower estimates of impact that we make in our Step 1 analyses.

As the above discussion indicates, our Step 1 analyses will tend to overestimate economic impacts of marine reserves on the recreational fishing community and associated industries in the local and regional economies. This is true even with our assumption of 50% local residency.

Consumer's Surplus. We conducted a review of literature for studies that have estimated the consumer's surplus values for the various recreational uses in the CINMS. We were able to obtain five studies for California or Southern California, however only two of these provided enough information on values that could be used (both were for fishing) (Table 1.20). The average value for all studies was $11.58 per person-day. We use this value for all consumptive and nonconsumptive recreation activities and note that it is only a rough approximation. The fact that there is no differentiation between consumptive and nonconsumptive recreation activities for this measurement limits our ability to analyze trade-offs in maximizing the economic value of CINMS resources. This would not be adequate information for a formal benefit-cost analysis.

Table 1.19. Economic Impact of Charter/Party Boat Fishing in Ventura County from Activity in the CINMS, 1999

Expenditure Category	Expenditure Per Person Per Day $	Total Expenditures $	Wages to Sales Ratio	Wages & Salary	Wages to Employment Ratio	Employment
Food	15.47	2,299,428	0.171537003	394,437	11740.46679	33.6
Lodging	8.65	1,285,718	0.213109652	273,999	14138.05668	19.4
Private Transportation	16.64	2,473,334	0.166580417	412,009	21582.30187	19.1
Public Transportation	33.07	4,915,455	0.166580417	818,818	21582.30187	37.9
Boat Fuel	0.00	0	0.037661501	0	13082.33276	0.0
Access/Boat launch Fees	1.18	175,393	0.197079821	34,566	26686.02901	1.3
Equipment Rental	6.01	893,314	0.24102252	215,309	26205.88235	8.2
Bait and Ice	0.52	77,292	0.105851657	8,181	19902.47277	0.4
Charter Boat fee	47.62	7,078,154	0.229005998	1,620,940	24,860	65.2
Total	129.16	**19,198,086**		**3,778,260**		**185.1**

Total Income to Wages & Salaries Regional Income Multiplier	2.338143047			Total Direct Income[1]	8,834,111	Total Direct Employment[2] 254.3
Lower 2.0			Lower	Total Income[3] **13,251,167**	Lower	Total Employment[4] **317.8**
Upper 2.5			Upper	**15,459,695**	Upper	**381.4**
Proprietors Income to Total Income by Work	0.164550026			% County by		% County
Proprietors Income to Employment	21027.31293			Place of Work	0.127%	0.388%
Regional Employment Multiplier						
Lower 1.5				% County by		
Upper 2.0				Place of Residence	0.072%	

1. Direct wages and salaries is calculated using the following formula: xα (see below for symbol definitions).
2. Direct employment is calculated by using the following formula: (βx)/γ + y (see below for definitions).
3. Total income is calculated by using the following formula: Xμ" (see below for symbol definitions).
4. Total employment is calculated by using the following formula: Yδ" (see below for symbol definitions).

α = Ratio of total income to wages and salaries.
β = Ratio of proprietors income to total income by work.
γ = Ratio of proprietors income to employment.
μ" = Regional income multipliers (upper and lower range).
δ" = Regional employment multipliers (upper and lower range).
x=Wages and salaries
y=employment
X=Direct wages and salaries
Y=Direct Employment

Ethnographic Data Survey. As noted in the section above on the commercial fisheries, the CINMS had an ethnographic data survey conducted prior to the beginning of their management plan revision process (Kronman et al, 2000). The number of people surveyed included four (4) operators of commercial passenger-carrying fishing vessels (what we call here the "for hire" industry or charter/party boat operators), four (4) operators of commercial passenger-carrying dive vessels, five (5) recreational fishermen, five (5) recreational divers, one (1) kayaker, two (2) operators of commercial passenger-carrying whale watching vessels, one (1) surfer and one (1) birdwatcher. Information from this survey provides some information that will aid in Step 2 analyses.

Table 1.20 Economic Parameters for Recreation Activities

Study[1]	Valuation Method	Valuation Estimate	Activity	Geographic Coverage
NMFS, 1980	Travel Cost	None given[2]	Fishing	Mexican Border up to and including San Francisco Bay, except the Monterey, Santa Cruz area.
Rowe, et. al. 1985	Multinomial Logit Travel Cost[3]	Santa Barbara County: $6.90 Ventura: $4.74 San Luis Obispo: $7.29	Fishing	California, Oregon and Washington by coastal county.
Wegge, et. al. 1983	Travel Cost & Contingent Valuation	TC:Charter/ Party boat: $5.33 Private boat: $17.92 CV: Charter Party:$5.45 Rental Boat: $15.00 Private Boat: $30.00[4]	Fishing	Northern border of San Luis Obispo County to Mexican border and 40 miles inland (by zip code).
Thomson and Crooke, 1991	Contingent Valuation	None Given[5]	Fishing	Coastal counties from San Luis Obispo to the Mexican Border.
Hanemann et. al. 1991	Travel Cost	[6]	Fishing	MRFSS Southern California Region (Santa Barbara County Southward).
Gentner, et. al. 2001	n/a	Expenditure Profiles (See Table 1.18)	Fishing	Pacfic Coast

1. See the References section for full citations.
2. The travel cost model was estimated, but valuation estimates were not calculated.
3. The way the CS estimates were calculated is by using the probability that an individual will take a trip to each available site/mode alternative under alternative resource price and quality conditions. The study gives a matrix of CS estimates by destination county, county of origin and mode of fishing. According to the explanation of the estimation method, "Expected consumer's surplus decreases for fishermen from counties further away from the site. This reflects that they have a lower probability of visiting the site on any one visit and , by being further away they have higher expenditures and lower CS associated with the site." For this reason I've included here only estimates for the same county of origin and the destination. Also, I only included boat modes. Amounts are per person per trip estimates in 1981 dollars.
4. Travel cost values given in the report were person-trip estimates. The CV estimates are person-day values, except for charter/party boat estimate which is person-trip. The estimates shown here are all person-day estimates. The estimates which were given as per-trip in the report were translated into person-day estimates by dividing the per-trip estimates by the average trip length of 4.13.
5. Contingent valuation questions were asked and a series of tables with answers were presented, however no benefits estimates were developed from the CV answers.
6. The only CS estimates published were aggregate annual figures. There was insufficient information in the report to break these figures down to per-person-per-day figures.

Table 1.21 Baseline Consumptive Recreation Activity

	Charter/Party Boat Fishing	Charter/Party Boat Diving	Private Boat Fishing	Private Boat Diving
Person-days	158,768	17,934	214,015	47,190
Market Impact				
Direct Sales	$ 20,638,407	$ 3,008,782	$ 8,888,043	$ 2,595,450
Direct Wages and Salaries	$ 9,475,042	$ 1,449,065	$ 2,499,255	$ 683,447
Direct Employment	279	48	85	24
Total Income				
Upper Bound	$ 16,581,324	$ 2,535,864	$ 4,373,697	$ 1,196,032
Lower Bound	$ 14,212,564	$ 2,173,598	$ 3,748,883	$ 1,025,171
Total Employment				
Upper Bound	418	72	127	37
Lower Bound	348	60	106	31
Non-Market Impact				
Consumer's Surplus[1]	$ 1,838,358	$ 207,642	$ 2,478,026	$ 545,243
Profit[2]	$ 376,295	$ 44,004	n/a	n/a

1. Consumer's Surplus is calculated by multiplying the average consumer's surplus per person per day from the the studies on the attached reference list (11.58) by the number of person days in this table.
2. Profit is used as a proxy for producer's surplus.

Table 1.22. Baseline Non-consumptive Recreation Activity

	Whale Watching	NC Diving	Sailing	Kayaking/ Sightseeing
Person-days	25,984	10,776	4,015	1,233
Market Impact				
Direct Sales	$ 4,288,337	$ 1,858,879	$ 694,305	$ 257,489
Direct Wages and Salaries	$ 2,084,969	$ 899,833	$ 326,370	$ 129,259
Direct Employment	72	31	10	5
Total Income				
Upper Bound	$ 3,648,695	$ 1,574,708	$ 571,147	$ 226,203
Lower Bound	$ 3,127,453	$ 1,349,750	$ 489,554	$ 193,888
Total Employment				
Upper Bound	108	47	16	8
Lower Bound	90	39	13	7
Non-Market Impact				
Consumer's Surplus[1]	$ 300,862	$ 124,767	$ 46,489	$ 14,277
Profit[2]	$ 157,235	$ 46,313	$ 18,020	$ 2,767

1. Consumer's Surplus is calculated by multiplying the average consumer's surplus per person per day from the the studies on the attached reference list (11.58) by the number of person days in this table.
2. Profit is used as a proxy for producer's surplus.

A Note on our Baseline Estimates. Above we discussed our choices of the 1996-1999 annual averages for the commercial fisheries and the 1999 estimates of use for the recreational consumptive users as baselines and for extrapolating future impacts. Scholz (2001) has questioned our selection of the 1996-1999 averages for extrapolating about future impacts and argues that our 1996-1999 averages are too high. Scholz cites the declining trends in the value of the entire California commercial fishery over the last 20 years, noting an average annual decline of 6.6%. Scholz also cites recent changes in fishing regulations in the limited entry fixed gear fishery off California by the NMFS to conclude our 1996-1999 baseline is not sustainable. Also cited is a CDFG recommended emergency closure of all offshore rockfish and lingcod sport fisheries south of Cape Mendocino, which would suggest that our baseline 1999 estimates for the recreational or sports fisheries are also not sustainable. Scholz also discusses the noted differences in the overall trends of the commercial fisheries in the CINMS versus the State of California (included here in Appendix C) and concludes that this represents a shift of effort from other California waters suffering from declining stocks and increasing regulations. In addition to being driven by changes in resource availability and regulation along the mainland, changes in fishing technology that have enabled fishermen to venture further from port, and the development of shore-side receiving and processing infrastructure have facilitated the further exploration and increased use of these fishing grounds (Pomeroy et. al. in press). Here the point is about the possibility of there being excess capacity in the commercial fisheries and whether the current capacity is sustainable in the future. Of course Scholz (2001) did not offer an alternative estimate of baselines for extrapolation because any estimate about the future as we noted above is fraught with uncertainty and could be just as vigorously criticized as our estimates. However, these are important issues and will be addressed in our Step 2 analyses.

Chapter 2

Step 1 Analysis of Alternatives

Description of Alternatives

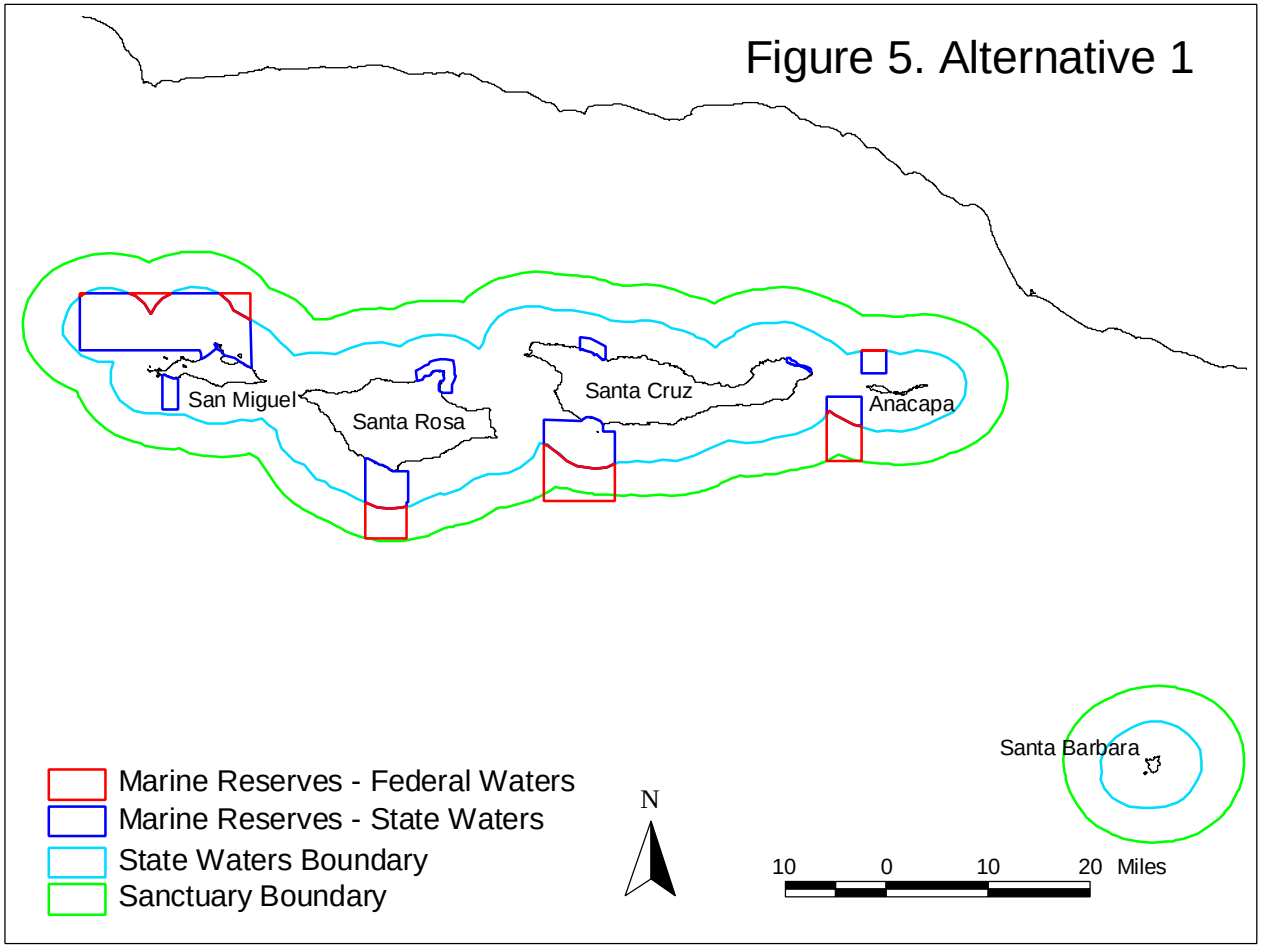
> **Definitions:**
>
> ***Marine Reserve***: No take area. All consumptive uses are displaced.
>
> ***Marine Park***: These areas are restricted to State waters and allow recreational lobster fishing.
>
> ***Marine Conservation Area***: These areas allow the take of recreational lobster and pelagic finfish, and the commercial take of lobster, crab, pelagic finfish, urchin and squid. These areas are not always restricted to State waters.

The CINMS and the State of California, as represented by the CDFG, have forwarded to us six alternatives for a network of marine reserves in the CINMS. One is labeled the Preferred Alternative i.e., the one preferred by the CINMS and the CDFG. Each alternative includes multiple areas with specific designations (e.g., marine reserves, marine conservation areas and marine parks). Marine reserves are complete "no take areas", while marine conservation areas and marine parks allow some consumptive activities. Areas also are segmented into those portions in State waters (under State jurisdiction) and those portions in Federal waters (under federal jurisdiction). Actually, the jurisdictional issue is more complicated in that there are multiple-jurisdictions over the same areas. The first nautical mile from the shoreline seaward on most islands is under the jurisdiction of the National Park Service, the State of California and the CINMS. The next two nautical miles seaward are under the joint jurisdiction of the State of California and the CINMS. From three nautical miles out to six nautical miles seaward are under the jurisdiction of CINMS and for purposes of Federal fishing regulations, the Pacific Fishery Management Council and the National Marine Fisheries Service. To complicate matters further, some species of fish are managed by the State of California in Federal waters (e.g. squid and some rockfishes), some are managed by the Federal government (Pacific Fishery Management Council and NMFS) in state waters (e.g. sardine and other rockfishes), and still others are managed by both state and federal authorities. We are not able to provide details on all these complex relationships. We simply use the geographic information system (GIS) to distinguish between State and Federal waters and provide separate estimates of activity within State and Federal waters.

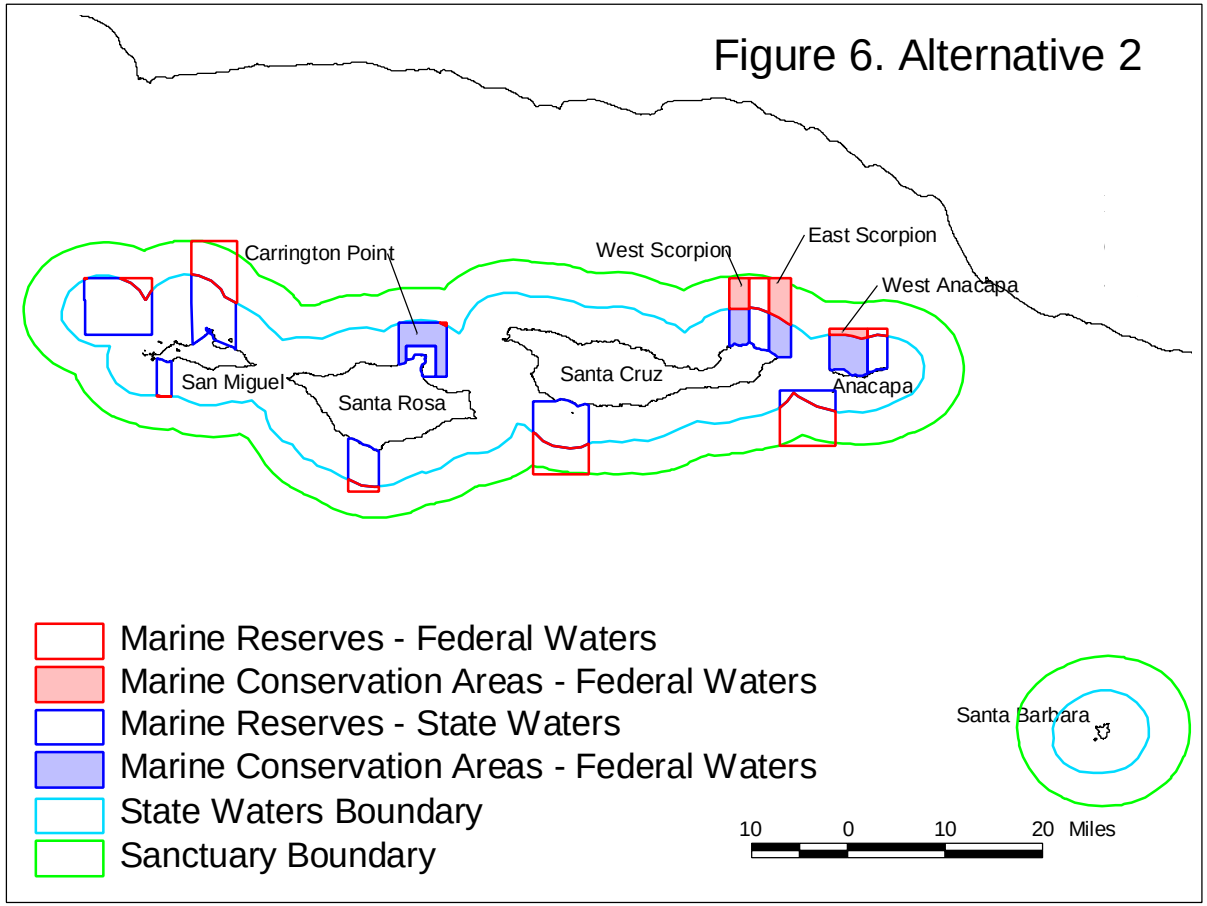
The following areas are closed to fishing, except as noted:

- West Anacapa SMCA (under the Preferred Alternative): allows commercial and recreational lobster fishing and recreational fishing for pelagic finfish.
- Carrington Point SMCA: allows commercial set net for halibut and white sea bass and commercial fishing for lobster, crab and urchin.
- Scorpion SMCA: allows recreational fishing for pelagic finfish, including yellowtail, tuna, mackerel, sardine, anchovy, and barracuda, and commercial fishing for wetfish, squid, and lobster.
- West Anacapa SMCA (under Alternative 2): allows recreational fishing for pelagic finfish, including yellowtail, tuna, mackerel, sardine, anchovy, and barracuda and commercial fishing for wetfish, squid and lobster.

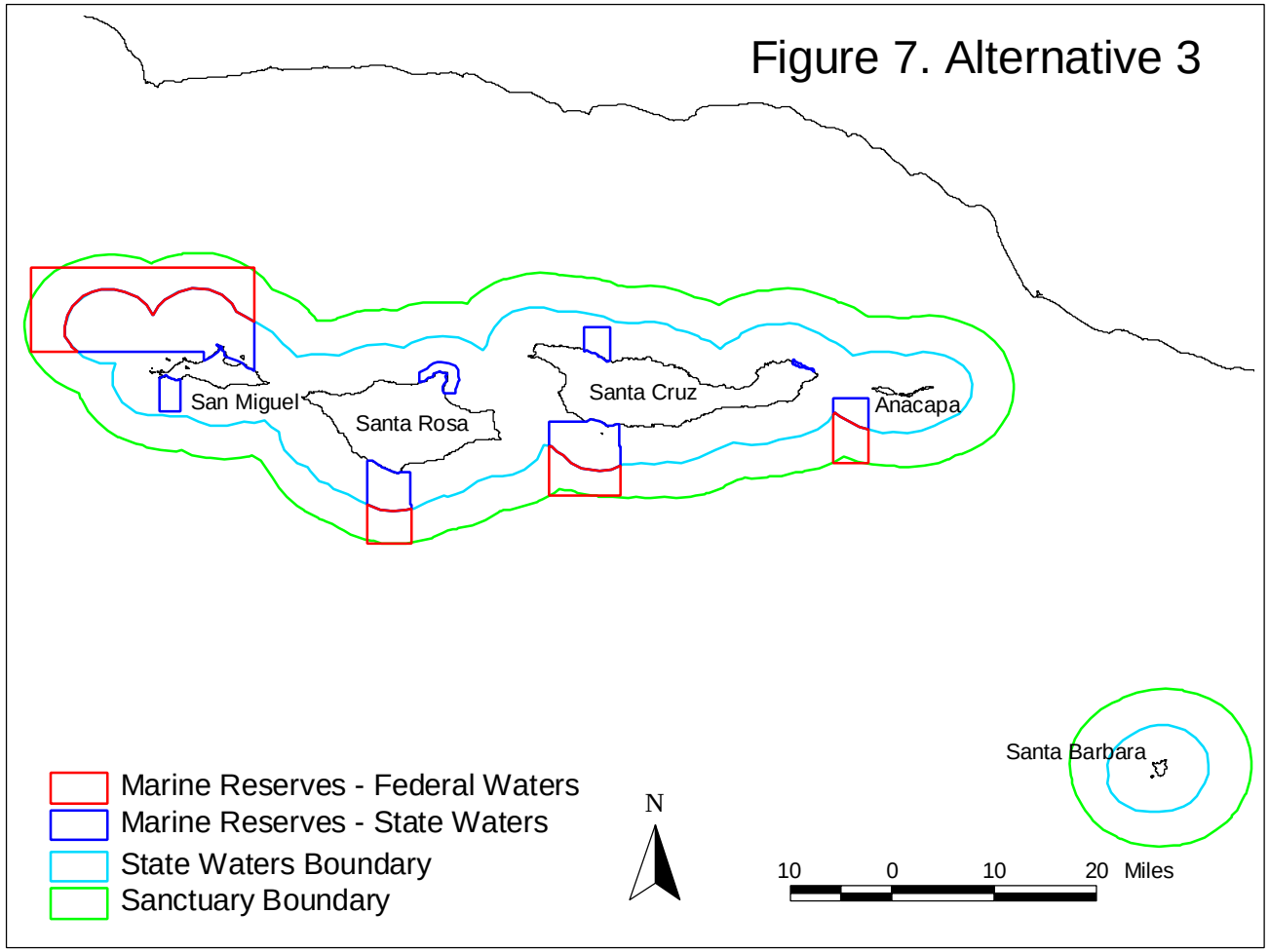
Alternative 1 – This alternative is comprised of eight areas and is approximately 186.5 nautical square miles in size, which is approximately 12 percent of all CINMS waters. All eight areas are marine reserves or no take areas. About 72 percent of the marine reserves are in State waters and 28 percent in Federal waters (Figure 5).



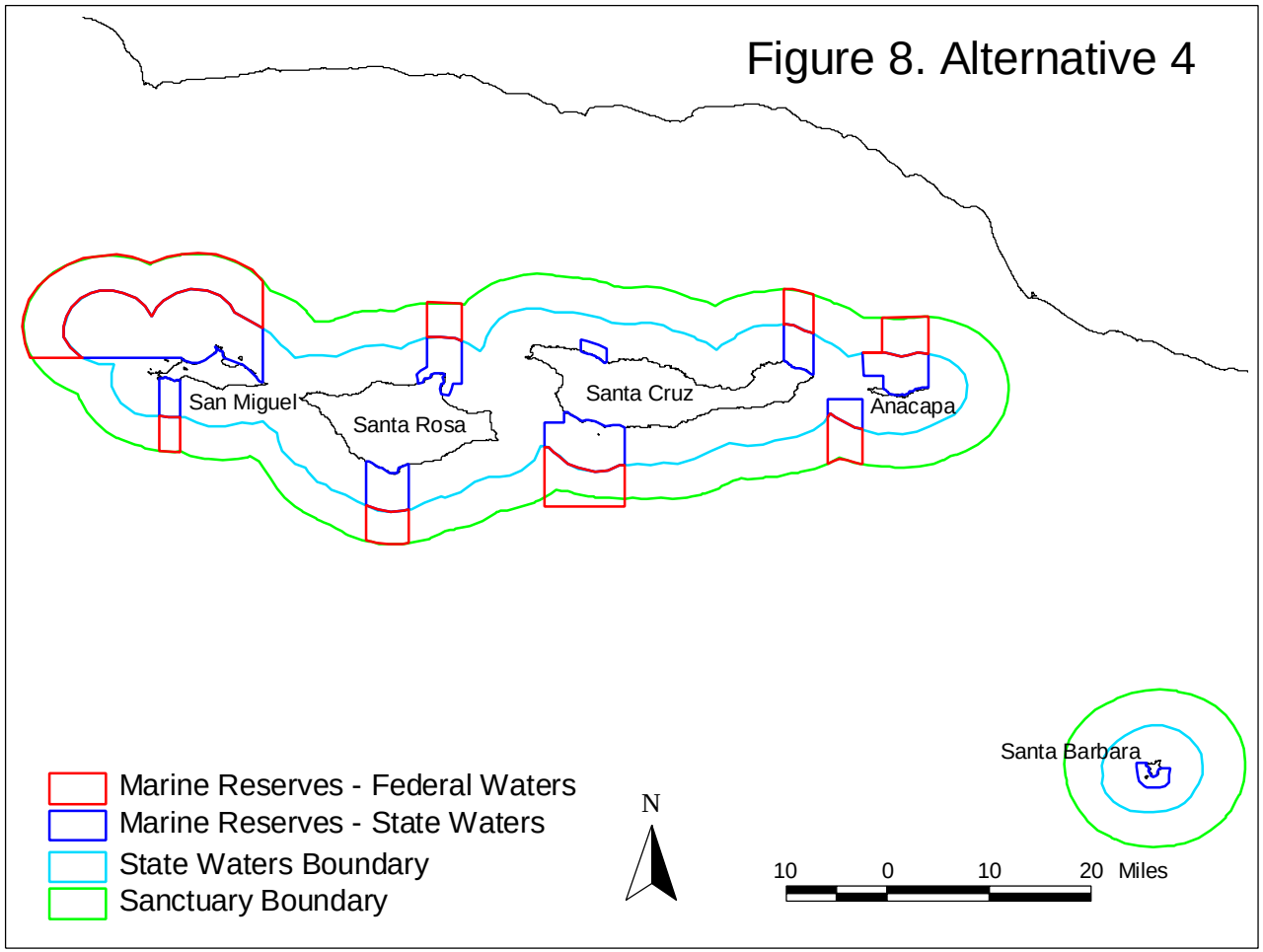
Alternative 2 – This alternative is comprised of 12 areas and is approximately 213.1 nautical square miles in size, which is approximately 14 percent of all CINMS waters. Eight of the areas are marine reserves and five of the areas are marine conservation areas. About 63 percent of the marine reserves are in State waters and 37 percent are in Federal waters. About 83 percent of the marine conservation areas are in State waters and 17 percent are in Federal waters. Overall, 67 percent of this alternative is in State waters and 33 percent is in Federal waters (Figure 6).



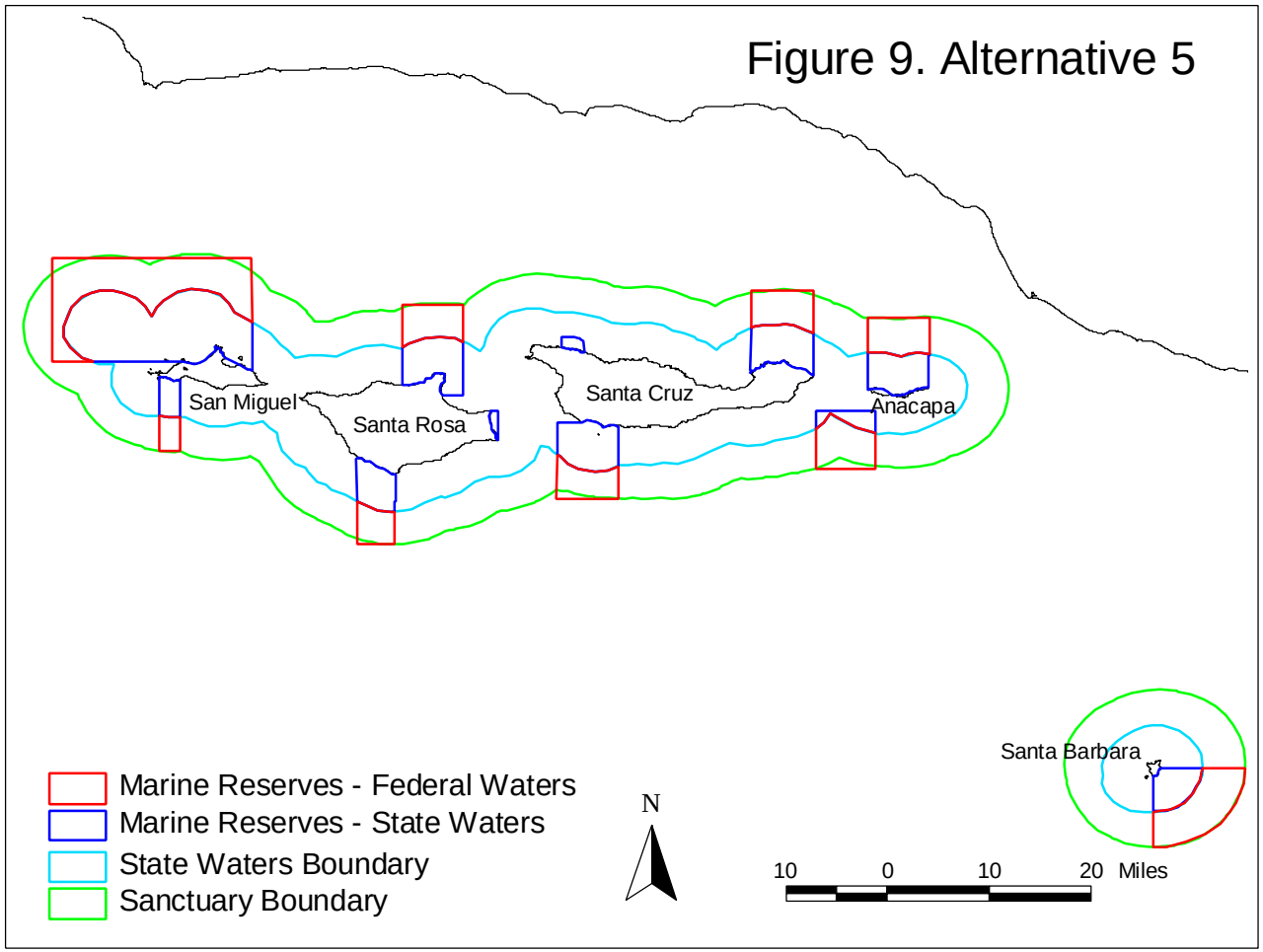
Alternative 3 – This alternative is comprised of seven areas all of which are marine reserves. The marine reserves cover 306.5 nautical square miles or approximately 21 percent of all CINMS waters. About 59 percent of the marine reserves are in State waters and 41 percent in Federal waters.



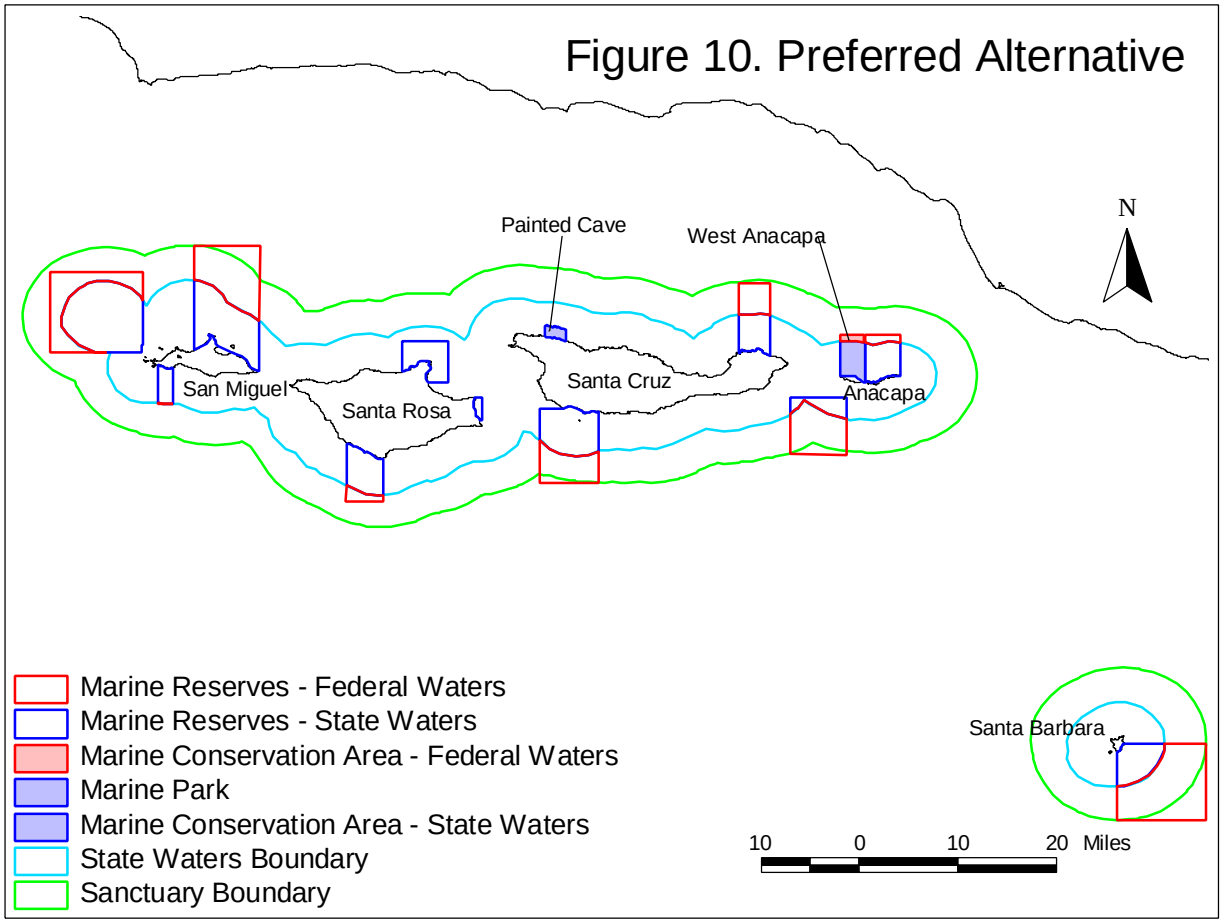
Alternative 4 – This alternative is comprised of 11 areas all of which are marine reserves. The marine reserves cover 450.1 nautical square miles or approximately 29 percent of all CINMS waters. About 52 percent of the marine reserves are in State waters and 48 percent are in Federal waters.



Alternative 5 – This alternative is comprised of 11 areas all of which are marine reserves. The marine reserves cover 516.5 nautical square miles or approximately 34 percent of all CINMS waters. About 50 percent of the marine reserves are in State waters and 50 percent are in Federal waters.



Preferred Alternative – This alternative is comprised of 13 areas covering 369.6 nautical square miles or approximately 25 percent of all CINMS waters. 11 of the areas are marine reserves, one is a marine conservation area and one is a State Marine Park. About 66 percent of the marine reserves are in State waters and 34 percent are in Federal waters. About 84 percent of the marine conservation area (West Anacapa) is in State waters and 16 percent is in Federal Waters. The Painted Cave State Marine Park is located on the northwestern portion of Santa Cruz Island. Overall, 54 percent of the areas are in State waters and 46 percent are in Federal waters.



Introduction - Step 1 Analysis

In the introduction, we discussed what is included and not included in Step 1 of our two step analyses. As a reminder, Step 1 of our analyses adds up the activities that are impacted by the various proposed marine reserve alternatives and translates these activities into the socioeconomic measures via the models outlined in Chapter 1. The assumption of Step 1 Analyses is that all revenues associated with the areas closed are lost. Any factor that could mitigate, offset, or increase the level of impact on any use is not addressed. In most cases, Step 1 impacts are thought of as "***maximum potential losses***" because humans have proven to be very adaptive, resilient and quite ingenious in responding to changes and rarely does society fail to at least mitigate or off-set most losses. Also, Step 1 analyses are limited to the cost side of the benefits and costs ledger. The "***potential"*** costs, or the impacts on current users/uses that will be displaced are the focus of Step 1. The benefits of marine reserves that were outlined in the introduction, along with the factors that might mitigate, offset or increase these potential costs are addressed in our Step 2 analyses.

Step 1 Analyses are presented here for the six alternatives described above. One alternative not specifically included in any tables is the "***no action alternative*** " or the status quo. The way to interpret the no action alternative is to assess it with respect to the other alternatives. Any costs of an alternative are costs avoided or benefits of the no action alternative. Likewise any benefits of an alternative are costs or opportunities lost by the no action alternative.

As part of the two-year Marine Reserve Working Group (MRWG) process of designing a network of marine reserves, we have analyzed many alternatives. Analyses for six of these alternatives are posted on the CINMS World Wide Web site in portable document format (downloadable pdfs). The alternatives were A, B, C, D, E, and I. Alternative A was the Science Panel's 50 percent alternative and Alternative B was the Science Panel's 30 percent alternative. Alternatives C, D, E, and I were developed by or presented to the MRWG. See http://www.cinms.nos.noaa.gov/MRWGsocioec/panel.html. We also conducted a day long workshop in Santa Barbara with commercial fishermen and some representatives of environmental groups that constructed five alternatives (most were some variant of Alternative C, which is posted on the Web site), for which we provided Step1 analyses at that time. We have also conducted Step 1 analyses for many other alternatives, some of which were referenced by letters (e.g., G and J) and others that did not have letters to guide where they fit in chronology. We have archived all the results of alternatives we have analyzed for different groups and the results are available from the authors upon request.

Commercial Fishing and Kelp – Step 1 Analysis

Given the six alternatives, 14 species/species groups, two jurisdictions (State waters and Federal waters), 12 ports of landing and seven counties in the impact area, Step 1 analyses produce many tables with a great deal of detail. We try to provide information that will fairly represent each user group and provide detail for management and policy decision-makers that must address the concerns of their constituencies. Here we present 29 tables of information in the body of the report and seven more detailed tables in Appendix D. Table 2.25 provides a summary of the Step 1 analyses for all six alternatives. Definitions of all terms and baseline estimates for the entire CINMS were included in Chapter 1 and are not repeated here. Most of the percents presented in the tables for ex vessel revenue, income or employment are the amount of impact as a percent of the CINMS baseline 1996-1999 annual average, except in the tables of ex vessel revenue by port. For ex vessel revenue by port, the percents are the impacted amounts as a percent of the entire port 1996-1999 annual average of ex vessel revenue from catch from all areas, not just the CINMS. This was done to help the ports address their concern about loosing dredging appropriations based on reduced amounts of commercial fishing.

Alternative 1. This alternative potentially impacts over $2.1 million in ***ex vessel revenue*** or 7.69 percent of all CINMS ex vessel revenue. Most of the impact is from catch in State waters (93%). All of the impact on harvest of kelp and catch of urchins, spiny lobsters, rockfish, crab, California sheephead, and sea cucumbers is in the State waters portion of the CINMS. Most of the impact on prawn and tuna catch is in Federal waters. As a percent of total CINMS catch, the largest impacts are on prawn (24.78%), urchins (13.96%), rockfish (13.28%) and sea cucumbers (12.76%). The smallest impacts are on kelp (4.43%), tuna

(4.71%), wetfish (4.91%), squid (5.46%) and flatfishes (5.53%). See Table 2.1 for the details on ex vessel revenue by species/species groups.

Table 2.1 Commercial Fishing & Kelp: Impact of Alternative 1 on Ex Vessel Value by Species Group - Step 1 Analysis

Species Group	State Waters Value	% [1]	Federal Waters Value	%	Total Value	%
Squid	$ 661,722	5.07	$ 51,227	0.39	$ 712,950	5.46
Kelp [2]	$ 265,568	4.43	$ -	0.00	$ 265,568	4.43
Urchins	$ 735,214	13.96	$ -	0.00	$ 735,214	13.96
Spiny Lobster	$ 81,627	8.85	$ -	0.00	$ 81,627	8.85
Prawn	$ 94,170	13.39	$ 80,095	11.39	$ 174,265	24.78
Rockfish	$ 72,964	13.28	$ -	0.00	$ 72,964	13.28
Crab	$ 26,331	7.66	$ -	0.00	$ 26,331	7.66
Tuna	$ 5,007	1.64	$ 9,382	3.07	$ 14,389	4.71
Wetfish	$ 9,994	3.31	$ 4,800	1.59	$ 14,794	4.91
CA Sheepshead	$ 24,024	10.18	$ -	0.00	$ 24,024	10.18
Flatfishes	$ 9,562	5.20	$ 600	0.33	$ 10,162	5.53
Sea Cucumbers	$ 21,406	12.76	$ -	0.00	$ 21,406	12.76
Sculpin & Bass	$ 4,435	7.35	$ 624	1.03	$ 5,059	8.39
Shark	$ 3,058	8.80	$ 144	0.41	$ 3,202	9.21
Total	$ 2,015,082	7.17	$ 146,873	0.52	$ 2,161,955	7.69

1. Percents are the amount of each species/species groups ex vessel value impacted by an alternative divided by the Study Area Total for the species/species group.
2. Kelp is processed value from ISP Alginates in San Diego.

Another view of impact is ex vessel revenue by port (Table 2.2). The greatest potential impact of this alternative is on the ports in Santa Barbara (9.98% of all ex vessel revenue of all landings at the port). In terms of dollar value of landings, Port Hueneme would potentially lose the next greatest amount (almost $604 thousand). However, Port Hueneme would potentially lose 4.43% of all ex vessel revenue, while Channels Islands Harbor would potentially lose 4.83%. Ventura Harbor would potentially lose 1.5% of the ex vessel value of all landings. All the other ports would potentially lose well under 1% in ex vessel revenue.

Table 2.2 Commercial Fishing & Kelp: Impacts of Alternative 1 on Ex Vessel Value by Port - Step 1 Analysis

Port	State Waters Value	% [1]	Federal Waters Value	%	Total Value	%
1. Moss Landing	3	N/A	1	N/A	4	N/A
2. Morro Bay	39	0.76	0	0.00	39	0.76
3. Avila/Port San Luis	17	0.00	1	0.00	19	0.00
4. Santa Barbara	852,406	9.92	5,116	0.06	857,523	9.98
5. Ventura Harbor	70,409	1.31	10,287	0.19	80,696	1.50
6. Channel Islands	170,227	3.48	65,863	1.35	236,090	4.83
7. Port Hueneme	553,819	4.06	49,954	0.37	603,773	4.43
8. San Pedro	66,681	0.48	5,938	0.04	72,618	0.52
9. Terminal Island	20,534	0.11	9,481	0.05	30,015	0.17
10. Avalon & Other LA	107	0.01	7	0.00	113	0.01
11. Newport Beach	5	0.00	7	0.00	12	0.00
12. San Diego	4,001	0.12	52	0.00	4,053	0.12

1. Percents are the amount of ex vessel value as a percent of the total ex vessel value of landings at the Port (1996-1999 Average Annual Value).

The impact on total income (Table 2.3) is over $5.7 million across all seven counties in the impact area. Most of the impacts are concentrated in Ventura and Santa Barbara counties. The impact in San Diego County is primarily from kelp harvesting and processing activities. Employment impacts mirror the income impacts with 168 full- and part-time jobs potentially impacted (Table 2.4).

Table 2.3 Commercial Fishing & Kelp: Impact of Alternative 1 on Total Income by County - Step 1 Analysis

County	State Waters Income	Federal Waters Income	Total Income
1. Monterey	$481,271	$37,261	$518,532
2. San Luis Obispo	$14,383	$32	$14,416
3. Santa Barbara	$1,679,016	$12,112	$1,691,129
4. Ventura	$2,279,347	$312,044	$2,591,391
5. Los Angeles	$481,003	$33,225	$514,227
6. Orange	$12	$16	$28
7. San Diego	$427,929	$168	$428,097
All Counties	$5,362,962	$394,857	$5,757,819

Table 2.4 Commercial Fishing & Kelp: Impacts of Alternative 1 on Total Employment by County - Step 1 Analysis

County	State Waters Employment	Federal Waters Employment	Total Employment
1. Monterey	14	1	15
2. San Luis Obispo	1	0	1
3. Santa Barbara	55	0	55
4. Ventura	69	9	79
5. Los Angeles	13	1	14
6. Orange	0	0	0
7. San Diego	4	0	4
All Counties	156	12	168

Alternative 2. This alternative potentially impacts over $2.2 million in ***ex vessel revenue*** or 7.9 percent of all CINMS ex vessel revenue. Most of the impact is from catch in State waters (94.7%). All of the impact on harvest of kelp and catch of urchins, spiny lobsters, crab, California Sheephead, and sea cucumbers is in the State waters portion of the CINMS. Most of the impact on prawn and tuna catch is in Federal waters. As a percent of total CINMS catch, the largest impacts are on prawn (19.41%), California Sheephead (18.76%), sea cucumbers (17.09%), sculpin & bass (14.74%), urchins (13.39%) and rockfish (12.6%). The smallest impacts are on tuna (5.36%), kelp (5.55%), and squid (5.56%). This alternative included some attempts to further limit impact by creating four Marine Conservation Areas (e.g., Carrington Point, Scorpion East, Scorpion West and Anacapa West). These MCAs or SMCAs, for those portions in State waters, allow commercial take of squid, spiny lobster, crab, urchin, and for selected pelagic finfish (tuna and wetfish). The impact on ex vessel revenue without these exemptions would have been over $3.3 million or 11.79 percent of all ex vessel revenue from the CINMS. The exemptions resulted in a reduction of potential impact of this alternative by one-third. See Table 2.5 for the details on ex vessel revenue by species/species groups.

Table 2.5 Commercial Fishing & Kelp: Impact of Alternative 2 on Ex Vessel Value by Species Group - Step 1 Analysis

Species Group	State Waters Value	State Waters % [1]	Federal Waters Value	Federal Waters %	Total Value	Total %
Squid	$ 712,953	5.46	$ 12,807	0.10	$ 725,760	5.56
Kelp [2]	$ 332,794	5.55	$ -	0.00	$ 332,794	5.55
Urchins	$ 704,761	13.39	$ -	0.00	$ 704,761	13.39
Spiny Lobster	$ 83,425	9.05	$ -	0.00	$ 83,425	9.05
Prawn	$ 63,271	9.00	$ 73,248	10.42	$ 136,519	19.41
Rockfish	$ 60,731	11.06	$ 8,458	1.54	$ 69,189	12.60
Crab	$ 26,943	7.84	$ -	0.00	$ 26,943	7.84
Tuna	$ 5,467	1.79	$ 10,910	3.57	$ 16,377	5.36
Wetfish	$ 12,573	4.17	$ 6,186	2.05	$ 18,759	6.22
CA Sheepshead	$ 44,262	18.76	$ -	0.00	$ 44,262	18.76
Flatfishes	$ 20,152	10.96	$ 2,775	1.51	$ 22,927	12.47
Sea Cucumbers	$ 28,667	17.09	$ -	0.00	$ 28,667	17.09
Sculpin & Bass	$ 6,004	9.95	$ 2,886	4.78	$ 8,890	14.74
Shark	$ 1,773	5.10	$ 450	1.29	$ 2,223	6.40
Total	$ 2,103,776	7.48	$ 117,720	0.42	$ 2,221,495	7.90

1. Percents are the amount of each species/species groups ex vessel value impacted by an alternative divided by the Study Area Total for the species/species group.
2. Kelp is processed value from ISP Alginates in San Diego.

Another view of impact is ex vessel revenue by port (Table 2.6). The greatest potential impact of this alternative is on the ports in Santa Barbara (9.71% of all ex vessel revenue of all landings at the port). In absolute amount, Port Hueneme would potentially lose the next greatest amount (almost $616 thousand or 4.52% of all ex vessel revenue of landings at the port). Channels Islands Harbor would potentially lose about $218.6 thousand or 4.83%. Ventura Harbor would potentially lose 1.7% of the ex vessel revenue of all landings. All the other ports would potentially lose well under 1% in ex vessel revenue.

Table 2.6 Commercial Fishing & Kelp: Impact of Alternative 2 on Ex Vessel Value by Port - Step 1 Analysis

Port	State Waters Value	State Waters % [1]	Federal Waters Value	Federal Waters %	Total Value	Total %
1. Moss Landing	$4	N/A	$2	N/A	$6	N/A
2. Morro Bay	$72	1.41	$0	0%	$72	1.41
3. Avila/Port San Luis	$33	0.00	$5	0%	$38	0.00
4. Santa Barbara	$822,512	9.57	$11,574	13%	$834,085	9.71
5. Ventura Harbor	$83,274	1.54	$8,609	16%	$91,883	1.70
6. Channel Islands	$155,890	3.19	$62,714	128%	$218,604	4.47
7. Port Hueneme	$596,426	4.37	$19,445	14%	$615,871	4.52
8. San Pedro	$74,519	0.53	$3,469	2%	$77,987	0.56
9. Terminal Island	$21,819	0.12	$10,126	6%	$31,945	0.18
10. Avalon & Other LA	$114	0.01	$2	0%	$116	0.01
11. Newport Beach	$5	0.00	$8	0%	$13	0.00
12. San Diego	$3,836	0.11	$62	0%	$3,898	0.12

1. Percents are the amount of ex vessel value as a percent of the total ex vessel value of landings at the Port (1996-1999 Average Annual Value).

The impact on total income (Table 2.7) is almost $5.9 million across all seven counties in the impact area. Most of the impacts are concentrated in Ventura and Santa Barbara counties. The impact in San Diego County is primarily from kelp. Employment impacts mirror the income impacts with 169 full and part-time jobs potentially impacted (Table 2.8).

Table 2.7 Commercial Fishing & Kelp: Impact of Alternative 2 on Total Income by County - Step 1 Analysis

County	State Waters Income	Federal Waters Income	Total Income
1. Monterey	$518,533	$9,319	$527,852
2. San Luis Obispo	$12,168	$1,628	$13,796
3. Santa Barbara	$1,625,984	$18,768	$1,644,751
4. Ventura	$2,418,613	$205,779	$2,624,392
5. Los Angeles	$522,535	$13,884	$536,419
6. Orange	$13	$19	$31
7. San Diego	$533,544	$196	$533,740
All Counties	$5,631,389	$249,592	$5,880,981

Table 2.8 Commercial Fishing & Kelp: Impact of Alternative 2 on Total Employment by County - Step 1 Analysis

County	State Waters Employment	Federal Waters Employment	Total Employment
1. Monterey	15	0	16
2. San Luis Obispo	0	0	1
3. Santa Barbara	53	1	53
4. Ventura	74	6	80
5. Los Angeles	14	0	14
6. Orange	0	0	0
7. San Diego	5	0	5
All Counties	161	8	169

Alternative 3. This alternative potentially impacts over $2.3 million in ***ex vessel revenue*** or 8.43 percent of all CINMS ex vessel revenue. Most of the impact is from catch in State waters (90%). All of the impact on harvest of kelp and catch of urchins, spiny lobsters, crab, California Sheephead, and sea cucumbers is in the State waters portion of the CINMS. Most of the impact on prawn and tuna catch is in Federal waters. As a percent of total CINMS catch, the largest impacts are on prawn (29.45%), rockfish (24.17%), urchins (14.32%), sea cucumbers (13.93%) and sculpin & bass (13.91%). The smallest impacts are on wetfish (4.93%), kelp (4.98%), and squid (5.66%). See Table 2.9 for the details on ex vessel revenue by species/species groups.

Table 2.9 Commercial Fishing & Kelp: Impact of Alternative 3 on Ex Vessel Value by Species Group - Step 1 Analysis

Species Group	State Waters Value	% [1]	Federal Waters Value	%	Total Value	%
Squid	$ 695,876	5.33	$ 42,689	0.33	$ 738,566	5.66
Kelp [2]	$ 298,241	4.98	$ -	0.00	$ 298,241	4.98
Urchins	$ 753,956	14.32	$ -	0.00	$ 753,956	14.32
Spiny Lobster	$ 97,403	10.56	$ -	0.00	$ 97,403	10.56
Prawn	$ 94,170	13.39	$ 112,927	16.06	$ 207,097	29.45
Rockfish	$ 88,222	16.06	$ 44,542	8.11	$ 132,764	24.17
Crab	$ 26,278	7.65	$ -	0.00	$ 26,278	7.65
Tuna	$ 5,812	1.90	$ 19,206	6.28	$ 25,019	8.19
Wetfish	$ 10,078	3.34	$ 4,800	1.59	$ 14,878	4.93
CA Sheepshead	$ 26,174	11.09	$ -	0.00	$ 26,174	11.09
Flatfishes	$ 9,562	5.20	$ 3,675	2.00	$ 13,237	7.20
Sea Cucumbers	$ 23,361	13.93	$ -	0.00	$ 23,361	13.93
Sculpin & Bass	$ 4,571	7.58	$ 3,822	6.34	$ 8,393	13.91
Shark	$ 2,906	8.36	$ 882	2.54	$ 3,788	10.90
Total	$ 2,136,610	7.60	$ 232,544	0.83	$ 2,369,154	8.43

1. Percents are the amount of each species/species groups ex vessel value impacted by an alternative divided by the Study Area Total for the species/species group.
2. Kelp is processed value from ISP Alginates in San Diego.

Another view of impact is ex vessel revenue by port (Table 2.10). The greatest potential impact of this alternative is on the ports in Santa Barbara (10.97% of all ex vessel revenue of all landings at the port). In absolute amount, Port Hueneme would potentially lose the next greatest amount (almost $627 thousand). However, Port Hueneme would potentially lose 4.59% of all ex vessel revenue, while Channels Islands Harbor would potentially lose 5.55%. Ventura Harbor would potentially lose 1.65% of the ex vessel value of all landings. All the other ports would potentially lose well under 1% in ex vessel revenue.

Table 2.10 Commercial Fishing & Kelp: Impact of Alternative 3 on Ex Vessel Value by Port - Step 1 Analysis

Port	State Waters Value	% [1]	Federal Waters Value	%	Total Value	%
1. Moss Landing	$3	N/A	$1	N/A	$5	N/A
2. Morro Bay	$43	0.83	$0	0.00	$43	0.83
3. Avila/Port San Luis	$17	0.00	$7	0.00	$24	0.00
4. Santa Barbara	$898,422	10.46	$44,472	0.52	$942,894	10.97
5. Ventura Harbor	$74,260	1.38	$14,607	0.27	$88,867	1.65
6. Channel Islands	$174,353	3.56	$97,396	1.99	$271,749	5.55
7. Port Hueneme	$581,830	4.27	$44,824	0.33	$626,654	4.59
8. San Pedro	$70,180	0.50	$6,937	0.05	$77,117	0.55
9. Terminal Island	$21,943	0.12	$17,937	0.10	$39,880	0.22
10. Avalon & Other LA	$115	0.01	$6	0.00	$121	0.01
11. Newport Beach	$5	0.00	$14	0.00	$20	0.00
12. San Diego	$4,106	0.12	$109	0.00	$4,214	0.12

1. Percents are the amount of ex vessel value as a percent of the total ex vessel value of landings at the Port (1996-1999 Average Annual Value).

The impact on total income (Table 2.11) is over $6.1 million across all seven counties in the impact area. Most of the impacts are concentrated in Ventura and Santa Barbara counties. The impact in San Diego County is primarily from kelp. Employment impacts mirror the income impacts with 179 full and part-time jobs potentially impacted (Table 2.12).

Table 2.11 Commercial Fishing & Kelp: Impact of Alternative 3 on Total Income by County - Step 1 Analysis

County	State Waters Income	Federal Waters Income	Total Income
1. Monterey	$506,111	$31,051	$537,163
2. San Luis Obispo	$17,315	$8,521	$25,836
3. Santa Barbara	$1,759,886	$61,295	$1,821,181
4. Ventura	$2,386,413	$363,219	$2,749,632
5. Los Angeles	$507,237	$32,523	$539,760
6. Orange	$13	$33	$46
7. San Diego	$479,688	$346	$480,034
All Counties	$5,656,664	$496,988	$6,153,652

Table 2.12 Commercial Fishing & Kelp: Impact of Alternative 3 on Total Employment by County - Step 1 Analysis

County	State Waters Employment	Federal Waters Employment	Total Employment
1. Monterey	15	1	16
2. San Luis Obispo	1	0	1
3. Santa Barbara	57	2	59
4. Ventura	73	11	84
5. Los Angeles	13	1	14
6. Orange	0	0	0
7. San Diego	5	0	5
All Counties	164	15	179

Alternative 4. This alternative potentially impacts over $4.1 million in ***ex vessel revenue*** or 14.74 percent of all CINMS ex vessel revenue. Most of the impact is from catch in State waters (92%). All of the impact on harvest of kelp and catch of urchins, spiny lobsters, crab, California Sheephead, and sea cucumbers is in the State waters portion of the CINMS. Most of the impact on prawn and tuna catch is in Federal waters. As a percent of total CINMS catch, the largest impacts are on prawn (41.11%), rockfish (30.01%), sculpin & bass (22.86%), California Sheephead (20.58%), urchins (20.29%), sea cucumbers (19.62%) and shark (19.61%). The smallest impacts are on kelp (7.81%), tuna (8.88%), and wetfish (9.13%). See Table 2.13 for the details on ex vessel revenue by species/species groups.

Table 2.13 Commercial Fishing & Kelp: Impact of Alternative 4 on Ex Vessel Value by Species Group - Step 1 Analysis

Species Group	State Waters Value	% [1]	Federal Waters Value	%	Total Value	%
Squid	$ 1,716,217	13.15	$ 55,496	0.43	$ 1,771,713	13.58
Kelp [2]	$ 467,886	7.81	$ -	0.00	$ 467,886	7.81
Urchins	$ 1,068,453	20.29	$ -	0.00	$ 1,068,453	20.29
Spiny Lobster	$ 150,333	16.30	$ -	0.00	$ 150,333	16.30
Prawn	$ 104,858	14.91	$ 184,214	26.20	$ 289,072	41.11
Rockfish	$ 116,040	21.12	$ 48,796	8.88	$ 164,836	30.01
Crab	$ 48,483	14.11	$ -	0.00	$ 48,483	14.11
Tuna	$ 7,886	2.58	$ 19,270	6.30	$ 27,156	8.88
Wetfish	$ 20,675	6.86	$ 6,853	2.27	$ 27,528	9.13
CA Sheepshead	$ 48,562	20.58	$ -	0.00	$ 48,562	20.58
Flatfishes	$ 20,546	11.17	$ 6,225	3.39	$ 26,771	14.56
Sea Cucumbers	$ 32,909	19.62	$ -	0.00	$ 32,909	19.62
Sculpin & Bass	$ 7,248	12.01	$ 6,543	10.85	$ 13,791	22.86
Shark	$ 5,321	15.31	$ 1,494	4.30	$ 6,815	19.61
Total	$ 3,815,416	13.57	$ 328,891	1.17	$ 4,144,308	14.74

1. Percents are the amount of each species/species groups ex vessel value impacted by an alternative divided by the Study Area Total for the species/species group.
2. Kelp is processed value from ISP Alginates in San Diego.

Another view of impact is ex vessel revenue by port (Table 2.14). The greatest potential impact of this alternative is on Port Hueneme. Port Hueneme potentially could lose almost $1.5 million or about 11 percent of all ex vessel revenue of landings at the port. Santa Barbara could potentially lose over $1.3 million, but this represents about 15.7% of all their ex vessel revenue from landings. Channels Islands Harbor would potentially lose 7.93%. Ventura Harbor would potentially lose almost 3.4% of the ex vessel value of all landings. All the other ports would potentially lose well under 1% in ex vessel revenue.

Table 2.14 Commercial Fishing & Kelp: Impact of Alternative 4 on Ex Vessel Value by Port - Step 1 Analysis

Port	State Waters Value	% [1]	Federal Waters Value	%	Total Value	%
1. Moss Landing	$6	N/A	$2	N/A	$8	N/A
2. Morro Bay	$79	1.55	$0	0.00	$79	1.55
3. Avila/Port San Luis	$37	0.00	$11	0.00	$48	0.00
4. Santa Barbara	$1,296,171	15.09	$52,361	0.61	$1,348,532	15.70
5. Ventura Harbor	$158,103	2.93	$22,943	0.43	$181,045	3.36
6. Channel Islands	$229,807	4.70	$158,169	3.23	$387,976	7.93
7. Port Hueneme	$1,425,261	10.45	$60,360	0.44	$1,485,621	10.89
8. San Pedro	$165,356	1.18	$8,986	0.06	$174,342	1.25
9. Terminal Island	$47,183	0.26	$18,543	0.10	$65,726	0.36
10. Avalon & Other LA	$259	0.01	$7	0.00	$267	0.01
11. Newport Beach	$9	0.00	$14	0.00	$23	0.00
12. San Diego	$5,819	0.17	$110	0.00	$5,929	0.18

1. Percents are the amount of ex vessel value as a percent of the total ex vessel value of landings at the Port (1996-1999 Average Annual Value).

The impact on total income (Table 2.15) is about $11.9 million across all seven counties in the impact area. Most of the impacts are concentrated in Ventura and Santa Barbara counties, although impacts to Monterey and Los Angeles counties are over $1.2 million. These larger impacts to Monterey and Los Angeles

counties are a result of this alternatives greater impact on squid landings. The impact in San Diego County is primarily from kelp. Employment impacts mirror the income impacts with 346 full and part-time jobs potentially impacted (Table 2.16).

Table 2.15 Commercial Fishing & Kelp: Impact of Alternative 4 on Total Income by County - Step 1 Analysis

County	State Waters Income	Federal Waters Income	Total Income
1. Monterey	$1,248,202	$40,367	$1,288,570
2. San Luis Obispo	$23,310	$9,348	$32,658
3. Santa Barbara	$2,557,664	$75,480	$2,633,144
4. Ventura	$5,377,737	$548,320	$5,926,057
5. Los Angeles	$1,210,094	$41,776	$1,251,870
6. Orange	$22	$33	$55
7. San Diego	$751,107	$350	$751,457
All Counties	$11,168,136	$715,674	$11,883,810

Table 2.16 Commercial Fishing & Kelp: Impact of Alternative 4 on Total Employment By County - Step 1 Analysis

County	State Waters Employment	Federal Waters Employment	Total Employment
1. Monterey	37	1	38
2. San Luis Obispo	1	0	1
3. Santa Barbara	83	2	85
4. Ventura	164	17	180
5. Los Angeles	32	1	33
6. Orange	0	0	0
7. San Diego	8	0	8
All Counties	324	22	346

Alternative 5. This alternative potentially impacts over $5.1 million in ***ex vessel revenue*** or 18.28 percent of all CINMS ex vessel revenue. Most of the impact is from catch in State waters (93.5%). All of the impact on harvest of kelp and catch of spiny lobsters, crab, California Sheephead, and sea cucumbers is in the State waters portion of the CINMS. Most of the impact on prawn and tuna catch, as is almost half of the wetfish impact, is in Federal waters. As a percent of total CINMS catch, the largest impacts are on rockfish (32.55%), prawn (29.26%), California Sheephead (26.74%), sea cucumbers (25.93%), sculpin & bass (25.91 %) and urchins (25.48%), and. The smallest impacts are on kelp (12.2%) and tuna (13.35%). See Table 2.17 for the details on ex vessel revenue by species/species groups.

Table 2.17 Commercial Fishing & Kelp: Impact of Alternative 5 on Ex Vessel Value by Species Group - Step 1 Analysis

Species Group	State Waters Value	% [1]	Federal Waters Value	%	Total Value	%
Squid	$ 2,079,098	15.94	$ 76,843	0.59	$ 2,155,941	16.52
Kelp [2]	$ 730,650	12.20	$ -	0.00	$ 730,650	12.20
Urchins	$ 1,338,737	25.43	$ 2,687	0.05	$ 1,341,424	25.48
Spiny Lobster	$ 202,201	21.93	$ -	0.00	$ 202,201	21.93
Prawn	$ 63,271	9.00	$ 142,504	20.27	$ 205,775	29.26
Rockfish	$ 144,957	26.39	$ 33,857	6.16	$ 178,814	32.55
Crab	$ 54,416	15.84	$ -	0.00	$ 54,416	15.84
Tuna	$ 9,495	3.11	$ 31,300	10.24	$ 40,794	13.35
Wetfish	$ 32,924	10.92	$ 31,249	10.36	$ 64,173	21.29
CA Sheepshead	$ 63,098	26.74	$ -	0.00	$ 63,098	26.74
Flatfishes	$ 28,421	15.46	$ 6,750	3.67	$ 35,171	19.13
Sea Cucumbers	$ 43,477	25.93	$ -	0.00	$ 43,477	25.93
Sculpin & Bass	$ 8,611	14.27	$ 7,020	11.64	$ 15,631	25.91
Shark	$ 6,351	18.28	$ 1,620	4.66	$ 7,971	22.94
Total	$ 4,805,706	17.10	$ 333,830	1.19	$ 5,139,536	18.28

1. Percents are the amount of each species/species groups ex vessel value impacted by an alternative divided by the Study Area Total for the species/species group.
2. Kelp is processed value from ISP Alginates in San Diego.

Another view of impact is ex vessel revenue by port (Table 2.18). The greatest potential impact of this alternative, in terms of percent of total port ex vessel revenue, is on the ports in Santa Barbara (19.41%). In absolute amount, Port Hueneme would potentially lose the greatest amount (over $1.8 million or 13.4% of the total port ex vessel revenue). Channels Islands Harbor would potentially lose 7.35%. Ventura Harbor would potentially lose 3.9% and San Pedro could potentially lose over $216 thousand or 1.55% of the ex vessel of all landings. All the other ports would potentially lose well under 1% in ex vessel revenue.

Table 2.18 Commercial Fishing & Kelp: Impact of Alternative 5 on Ex Vessel Value by Port - Step 1 Analysis

Port	State Waters Value	% [1]	Federal Waters Value	%	Total Value	%
1. Moss Landing	$10	N/A	$9	N/A	$19	N/A
2. Morro Bay	$103	2.01	$0	0.00	$103	2.01
3. Avila/Port San Luis	$50	0.00	$12	0.00	$62	0.00
4. Santa Barbara	$1,627,439	18.94	$40,122	0.47	$1,667,562	19.41
5. Ventura Harbor	$190,136	3.53	$21,143	0.39	$211,279	3.92
6. Channel Islands	$235,051	4.80	$124,611	2.55	$359,662	7.35
7. Port Hueneme	$1,730,254	12.69	$96,743	0.71	$1,826,997	13.40
8. San Pedro	$201,867	1.44	$14,451	0.10	$216,318	1.55
9. Terminal Island	$57,570	0.32	$30,770	0.17	$88,340	0.49
10. Avalon & Other LA	$320	0.02	$11	0.00	$331	0.02
11. Newport Beach	$10	0.00	$23	0.00	$33	0.01
12. San Diego	$7,288	0.22	$192	0.01	$7,480	0.22

1. Percents are the amount of ex vessel value as a percent of the total ex vessel value of landings at the Port (1996-1999 Average Annual Value).

The impact on total income (Table 2.19) is over $14.6 million across all seven counties in the impact area. Most of the impacts are concentrated in Ventura and Santa Barbara counties, with impacts of over $1.5 million in Monterey and Los Angeles counties. Like alternative 4, the impacts of alternative 5 have

broader impact because of the greater impact on squid. The impact in San Diego County is primarily from kelp. Employment impacts mirror the income impacts with 421 full and part-time jobs potentially impacted (Table 2.20).

Table 2.19 Commercial Fishing & Kelp: Impact of Alternative 5 on Total Income by County - Step 1 Analysis

County	State Waters Income	Federal Waters Income	Total Income
1. Monterey	$1,512,132	$55,911	$1,568,043
2. San Luis Obispo	$29,095	$6,517	$35,613
3. Santa Barbara	$3,203,964	$60,523	$3,264,487
4. Ventura	$6,452,097	$622,547	$7,074,645
5. Los Angeles	$1,472,076	$67,284	$1,539,360
6. Orange	$27	$53	$80
7. San Diego	$1,168,775	$598	$1,169,374
All Counties	$13,838,166	$813,434	$14,651,600

Table 2.20 Commercial Fishing & Kelp: Impact of Alternative 5 on Total Employment By County - Step 1 Analysis

County	State Waters Total Employment	Federal Waters Total Employment	Total Total Employment
1. Monterey	45	2	46
2. San Luis Obispo	1	0	1
3. Santa Barbara	104	2	106
4. Ventura	196	19	215
5. Los Angeles	39	2	41
6. Orange	0	0	0
7. San Diego	12	0	12
All Counties	397	25	421

Preferred Alternative. This alternative potentially impacts over $3.3 million in ***ex vessel revenue*** or 12.5 percent of all CINMS ex vessel revenue. Most of the impact is from catch in State waters (93.9%). All of the impact on harvest of kelp and catch of urchins, spiny lobsters, crab, California Sheephead, and sea cucumbers is in the State waters portion of the CINMS. Most of the impact on tuna and wetfish, as is about half the prawn impact, is in Federal waters. As a percent of total CINMS catch, the largest impacts are on rockfish (21.42%), wetfish (20.46%), prawn (16.7%), sculpin & bass (16.67%), sea cucumbers (16.54%), California Sheephead (16.37%), spiny lobsters (16.17%), and urchins (15.82%). The smallest impact is on kelp (5.55%). This alternative included some attempts to further limit impact on the commercial fisheries by one Marine Conservation Area (West Anacapa Island MCA and SMCA). This MCA and SMCA, for those portions in State waters, allow commercial take spiny lobster. The impact on ex vessel revenue without these exemptions would have been over $3.5 million or 12.56 percent of all ex vessel revenue from the CINMS. The exemptions resulted in a reduction of potential impact of this alternative by about 0.03%. See Table 2.21 for the details on ex vessel revenue by species/species groups.

Table 2.21 Commercial Fishing & Kelp: Impact of Preferred Alternative on Ex Vessel Value by Species Group - Step 1 Analysis

Species Group	State Waters Value	% [1]	Federal Waters Value	%	Total Value	%
Squid	$ 1,660,718	12.73	$ 51,230	0.39	$ 1,711,948	13.12
Kelp [2]	$ 332,794	5.55	$ -	0.00	$ 332,794	5.55
Urchins	$ 830,464	15.77	$ 2,687	0.05	$ 833,151	15.82
Spiny Lobster	$ 149,133	16.17	$ -	0.00	$ 149,133	16.17
Prawn	$ 58,615	8.34	$ 58,832	8.37	$ 117,447	16.70
Rockfish	$ 87,985	16.02	$ 29,653	5.40	$ 117,638	21.42
Crab	$ 50,139	14.59	$ -	0.00	$ 50,139	14.59
Tuna	$ 8,544	2.80	$ 31,991	10.47	$ 40,535	13.26
Wetfish	$ 28,511	9.46	$ 33,162	11.00	$ 61,673	20.46
CA Sheepshead	$ 38,622	16.37	$ -	0.00	$ 38,622	16.37
Flatfishes	$ 22,652	12.32	$ 3,000	1.63	$ 25,652	13.95
Sea Cucumbers	$ 27,731	16.54	$ -	0.00	$ 27,731	16.54
Sculpin & Bass	$ 6,865	11.38	$ 3,189	5.29	$ 10,054	16.67
Shark	$ 4,879	14.04	$ 720	2.07	$ 5,599	16.11
Total	$ 3,307,652	11.77	$ 214,463	0.76	$ 3,522,116	12.53

1. Percents are the amount of each species/species groups ex vessel value impacted by an alternative divided by the Study Area Total for the species/species group.
2. Kelp is processed value from ISP Alginates in San Diego.

Another view of impact is ex vessel revenue by port (Table 2.22). The greatest potential impact of this alternative, in terms of percent of total port ex vessel revenue, is on the ports in Santa Barbara (12.39%). In absolute amount, Port Hueneme would potentially lose the greatest amount (over $1.2 million or 9.14% of all ex vessel revenue of landings at the port). Channels Islands Harbor would potentially lose about $217 thousand or 4.43%. Ventura Harbor would potentially lose 2.6% of the ex vessel of all landings, while San Pedro would potentially lose about 1%. All the other ports would potentially lose extremely small amounts.

Table 2.22 Commercial Fishing & Kelp: Impact of Preferred Alternative on Ex Vessel Value by Port - Step 1 Analysis

Port	State Waters Value	% 1	Federal Waters Value	%	Total Value	%
1. Moss Landing	$9	N/A	$10	N/A	$19	N/A
2. Morro Bay	$63	1.23	$0	0.00	$63	1.23
3. Avila/Port San Luis	$40	0.00	$5	0.00	$45	0.00
4. Santa Barbara	$1,050,864	12.23	$31,396	0.37	$1,082,260	12.60
5. Ventura Harbor	$146,603	2.72	$10,240	0.19	$156,843	2.91
6. Channel Islands	$165,905	3.39	$52,642	1.08	$218,547	4.47
7. Port Hueneme	$1,384,342	10.15	$73,517	0.54	$1,457,859	10.69
8. San Pedro	$158,937	1.14	$11,445	0.08	$170,382	1.22
9. Terminal Island	$46,683	0.26	$30,688	0.17	$77,371	0.43
10. Avalon & Other LA	$252	0.01	$8	0.00	$260	0.01
11. Newport Beach	$9	0.00	$24	0.00	$33	0.00
12. San Diego	$4,538	0.13	$194	0.01	$4,732	0.14

1. Percents are the amount of ex vessel value as a percent of the total ex vessel value of landings at the Port (1996-1999 Average Annual Value).

The impact on total income (Table 2.23) is little over 10.6 million across all seven counties in the impact area. Most of the impacts are concentrated in Ventura and Santa Barbara counties, with about $1.2 million

in both Monterey and Los Angeles counties. As with alternatives 4 and 5, the Preferred Alternative's broader impact is largely due to the impacts on the squid fishery. The impact in San Diego County is primarily from kelp. Employment impacts mirror the income impacts with 312 full and part-time jobs potentially impacted (Table 2.24).

Table 2.23 Commercial Fishing & Kelp: Impact of Prefered Alternative on Total Income By County - Step 1 Analysis

County	State Waters Income	Federal Waters Income	Total Income
1. Monterey	$1,207,845	$37,284	$1,245,129
2. San Luis Obispo	$17,914	$5,688	$23,602
3. Santa Barbara	$2,085,917	$44,332	$2,130,249
4. Ventura	$5,102,153	$390,763	$5,492,917
5. Los Angeles	$1,174,655	$52,264	$1,226,918
6. Orange	$23	$54	$77
7. San Diego	$535,173	$606	$535,779
All Counties	$10,123,680	$530,992	$10,654,672

Table 2.24 Commercial Fishing & Kelp: Impact of Prefered Alternative on Total Employment By County - Step 1 Analysis

County	State Waters Employment	Federal Waters Employment	Total Employment
1. Monterey	36	1	37
2. San Luis Obispo	1	0	1
3. Santa Barbara	68	1	69
4. Ventura	155	12	167
5. Los Angeles	31	1	32
6. Orange	0	0	0
7. San Diego	5	0	5
All Counties	296	16	312

Summary and Comparative Impacts of Alternatives. In terms of percent of ex vessel revenue, income and employment potentially impacted and ranked from highest impact to lowest impact, the rankings are Alternatives 5, 4, Preferred, 3, 2, 1 (Table 2.25). The Preferred Alternative is in the mid-range of impacts among all alternatives. Another way to view the relative impacts, even in the limited Step 1 context, is to look at the ratio of the percent of CINMS habitat protected to the percent of income lost. The higher the ratio the more protection per dollar of income lost. Alternative 3 has the highest ratio (2.83) followed by Alternative 4 (2.02), Alternative 2 (1.97), The Preferred Alternative (1.95), and Alternative 5 (1.92). Alternative 1 has a ratio of 1.73, and thus the highest cost per unit protection. Even though Alternative 3 is in the mid range with respect to percent of habitat protected (21 percent), it is expected to have the least negative impact (or lowest cost) per unit of resource protected.

Table 2.25 Commercial Fishing & Kelp: Summary of Impacts by Alternative - Step 1 Analysis

Alternative	State Waters $/#	State Waters % [1]	Federal Waters $/#	Federal Waters %	Total $/#	Total %
			Ex Vessel Revenue [2]			
1	$2,015,082	7.17	$146,873	0.52	$2,161,955	7.69
2	$2,103,776	7.48	$117,720	0.42	$2,221,495	7.90
3	$2,136,610	7.60	$232,544	0.83	$2,369,154	8.43
4	$3,815,416	13.57	$328,891	1.17	$4,144,308	14.74
5	$4,805,706	17.10	$333,830	1.19	$5,139,536	18.28
Preferred	$3,307,652	11.77	$214,463	0.76	$3,522,116	12.53
			Income [3]			
1	$5,362,962	6.47	$394,857	0.48	$5,757,819	6.94
2	$5,631,389	6.79	$249,592	0.30	$5,880,981	7.09
3	$5,656,664	6.82	$496,988	0.60	$6,153,652	7.42
4	$11,168,136	13.47	$715,674	0.86	$11,883,810	14.33
5	$13,838,166	16.69	$813,434	0.98	$14,651,600	17.67
Preferred	$10,123,680	12.21	$530,992	0.64	$10,654,672	12.85
			Employment [4]			
1	156	6.76	12	0.52	168	7.28
2	161	6.98	8	0.35	169	7.33
3	164	7.11	15	0.65	179	7.76
4	324	14.04	22	0.95	346	15.00
5	397	17.21	25	1.08	422	18.29
Preferred	296	12.82	16	0.69	312	13.51

1. Percents are the percent of total baseline 1996-1999 impacted.
2. Ex vessel Revenue received by fishermen and processed value of kelp, Baseline Annual Average 1996-1999 for the entire CINMS is equal to $28,111,179.
3. Income is total income, including multiplier impacts. Baseline Annual Average 1996-1999 for the entire CINMS is equal to $82, 913,552.
4. Employment is total employment, including multiplier impacts. Baseline Annual Average 1996-1999 for the entire CINMS is equal to 2,307.

Impacts on Individual Fishermen. The above analyses were on the economic dimensions of the potential impacts of alternatives and at a broad level (across the whole fishery). Chapter 1 presented socioeconomic profiles for the Barilotti (Table 1.9) and Pomeroy (Table 1.10) samples. We looked at the profiles of both samples for each alternative. All of the Barilotti sample of fishermen would be impacted by the Preferred Alternative and Alternatives 2, 4, and 5. 55 of the 59 fishermen in the Barilotti sample would be impacted by Alternatives 1 and 3. All the Pomeroy sampled fishermen (squid/wetfish fishermen) would be impacted by all the alternatives. Further, there were no statistically significant differences between the full Barilotti sample and those impacted by any of the alternatives for any socioeconomic characteristic such as experience, age, education, dependency on fishing, crew and family dependent on fishing, ownership and investment in fishing boats and equipment or location of residence or ports used. Appendix D, Table D.7 includes a comparison of socioeconomic profiles by alternatives.

What is different across alternatives is the extent of potential impacts on individual fishermen. We first classified fishermen according to levels of dependence on their total fishing revenue derived from the CINMS. The information is from CDFG trip ticket or PacFIN information for individual fishermen. Information is reported by species and CDFG block where each fisherman catches fish. From our samples,

we also obtained the percent of their incomes that come from fishing. We were thus able to calculate the percent of a fisherman's total income from all sources that would be potentially impacted by each alternative. The results for the Barilotti sample are in Table 2.26 and the results for the Pomeroy sample in Table 2.27.

Table 2.26 Summary of Ranges of Potential Losses of Income to Individual Fishermen: Barilotti Sample - Step 1 Analysis

Percent of Revenue Derived from Fishing In CINMS [1]	Percent of Income Loss					
	Alternatives					
	1	2	3	4	5	Preferred
80 - 100 (N=30)	0.87 - 20.92	2.36 - 19.93	0.87 - 20.92	4.37 - 27.90	6.88 - 30.69	2.36 - 23.71
60 - 80 (N=6)	5.15 - 15.53	7.73 - 18.63	5.15 - 18.63	10.13 - 24.84	12.88 - 31.05	9.02 - 18.63
40 - 60 (N=7)	0.00 - 8.43	0.00 - 9.08	0.00 - 8.43	0.00 - 10.37	3.27 - 14.27	1.09 - 11.68
20 - 40 (N=4)	0.00 - 5.84	2.41 - 6.57	0.00 - 5.84	2.41 - 6.80	1.81 - 10.22	1.20 - 6.01
0 - 20 (N=7)	0.05 - 2.19	0.06 - 2.99	0.05 - 2.04	0.09 - 3.86	0.11 - 4.08	0.06 - 2.99
All (N=54)	0.00 - 20.92	0.00 - 19.93	0.00 - 20.92	0.00 - 27.90	0.11 - 31.05	0.06 - 23.71

1. Percents of fishing revenues show dependency on CINMS. The N-value in parentheses is the number of fishermen from the Barilotti Sample that earn the range of percent of revenues from fishing in the CINMS.
2. Income is total income from all sources.

Table 2.27 Summary of Ranges of Potential Losses of Income to Individual Squid/Wefish Fishermen - Step 1 Analysis

Percent of Revenue Derived from Fishing In CINMS [1]	Percent of Income Loss					
	Alternatives					
	1	2	3	4	5	Preferred
80 - 100 (N=9)	1.88 - 6.76	6.04 - 14.88	2.81 - 7.44	6.62 - 14.81	9.64 - 17.35	6.62 - 14.52
60 - 80 (N=7)	0.65 - 7.02	1.15 - 16.24	0.94 - 7.61	1.44 - 15.43	1.94 - 21.03	1.66 - 15.83
40 - 60 (N=3)	2.84 - 5.30	6.98 - 11.83	5.23 - 9.54	1.31 - 10.52	8.13 - 14.84	6.66 - 11.83
20 - 40 (N=8)	0.19 - 7.33	0.42 - 9.70	0.16 - 8.09	0.47 - 11.29	0.87 - 13.38	0.87 - 10.22
0 - 20 (N=6)	0.02 - 0.60	0.09 - 1.00	0.03 - 0.63	0.11 - 1.02	0.16 - 1.98	0.12 - 1.06
All (N=33)	0.02 - 7.33	0.09 - 16.24	0.03 - 9.54	0.11 - 15.43	0.16 - 21.03	0.12 - 15.83

1. Percents of fishing revenues show dependency on CINMS. The N-value in parentheses is the number of sampled squid/wetfish fishermen in the sample that earn the range of percent of revenues from fishing in the CINMS.
2. Income is total income from all sources.

The Barilotti sample appears to be highly dependent on the CINMS for their catch with 30 of 54 fishermen or 55.55% deriving 80 to 100 percent of their fishing revenue from the CINMS. The range of potential impacts for this most dependent group rank identically to total ex vessel revenue as discussed in our more aggregate analysis. The same patterns hold for the group that depends on the CINMS for 60 to 80 percent of their fishing revenue. Generally, one can see as the level of dependency on the CINMS for fishing revenues falls, the ranges of percent of income potentially impacted declines as expected. The maximum impact on an individual fisherman's income is 31 percent for Alternative 5, followed by 27.9 percent for Alternative 4 and 23.7 percent for the Preferred Alternative. The maximum was 20.92 for both Alternative 3 and Alternative 1, while the maximum for alternative 2 was 19.9 percent.

The Pomeroy sample (squid/wetfish fishermen) showed less dependency than the Barilotti sample on the CINMS for their total fishing revenue and the maximum impacts on their incomes was only about half that of the Barilotti sample. Nine (9) of the 33 (27%) purse seine and light boat operators that reported full information depended on Channel Islands fisheries for 80 to 100 percent of their fishing revenue. The ranking across alternatives was somewhat different from that of our more aggregated analysis for this group, who are most dependent on Channel Islands fisheries. Alternative 5 had the greatest impact followed by Alternative 2, Alternative 4, the Preferred Alternative, Alternative 3 and Alternative 1. Seven (7) or 21 percent of the Pomeroy sample depend on Channel Islands fisheries for 60 to 80 percent of their fishing revenues. The ranking here was again different for this group across alternatives. Alternatives 5 and 2 still had the greatest impact on this group, whereas the Preferred Alternative had a slightly higher, but not significantly different impact than Alternative 4. Alternatives 3 and 1 had the lowest impact for this group.

In Tables 2.28 and 2.29, we organized the Barilotti and Pomeroy sample according to the ranges of potentially lost income. In these displays, one can see the relative impacts across alternatives. Alternatives 5 and 4 are the only alternative for which any one in either the Barilotti or Pomeroy samples would potentially lose more than 25 percent of their income. Except for Alternative 5, very few fishermen would lose more than 20 percent of their incomes. 57 percent of the Barilotti sample and two-thirds of the Pomeroy sample would potentially lose 10 percent or less of their income under the Preferred Alternative.

Table 2.28 Summary Impact on Income of Individual Fishermen: Barilotti Sample - Step 1 Analysis

	Number of Fishermen in Sample [1]					
Percent of Income	Alternatives					
Potentially Lost	1	2	3	4	5	Preferred
0 - 1.0	9	6	9	5	3	5
1.01 - 5.0	10	9	10	9	6	9
5.01 - 10.0	16	16	16	9	9	17
10.01 - 15.0	11	12	11	14	10	10
15.01 - 20.0	7	11	7	11	8	10
20.01 - 25.0	1	0	1	5	12	3
25.01 - 31.05	0	0	0	1	6	0

1. 54 Fishermen form the Barilotti Sample with reported revenues and household income.

Table 2.29 Summary Impact on Income of Individual Squid/Wefish Fishermen - Step 1 Analysis

Percent of Income Potentially Lost	Number of Fishermen in Sample [1]					
	Alternatives					
	1	2	3	4	5	Preferred
0 - 1.0	9	7	9	5	5	5
1.01 - 5.0	17	3	14	7	5	5
5.01 - 10.0	7	12	10	8	5	12
10.01 - 15.0	0	10	0	12	12	10
15.01 - 17.35	0	1	0	1	6	1

1. 33 Squid/Wetfish fishermen with reported reveneues.

Recreation Industry

The interpretation of the estimates provided in this analysis is critical to understanding the "true" impact of the various alternatives proposed for the Channel Islands Marine Reserve system. As was mentioned above, the estimates from our GIS analysis for the different boundary alternatives (step one) are simply the sum of each measurement within the boundaries for a given alternative. The estimates therefore represent the **maximum total potential loss from displacement of the consumptive recreational activities**. This analysis ignores possible mitigating factors and the possibility of net benefits that might be derived if the proposed marine reserve system has replenishment effects. Although we don't have the ability to quantify either the extent of the mitigating factors or the potential benefits from replenishment, we will discuss these as well as other potential benefits of the proposed marine reserve system after we have presented and discussed the maximum potential losses from displacement of the current consumptive recreational uses.

The analysis is separated into two steps, step 1) costs, and step 2) benefits/mitigating factors. In the step one analysis, maximum potential loss of income for consumptive activities is presented for state waters, for federal waters, and in total for each alternative. For the preferred alternative, in addition to these analyses, a separate step one analysis will be made for each individual reserve. This analysis may be found in Appendix G. In the step two analysis, baseline economic impact is presented for non-consumptive activities for state waters, federal waters, and in total for each alternative.

Recreation: Consumptive Activities – Step 1 Analysis

No-Action Alternative. The no action alternative simply means that the proposed Channel Islands Marine reserve system and corresponding no take regulations would not take place. The no action alternative has a simple interpretation in that any costs of imposing the no take regulations, for any given alternative with no take regulations, would be the benefits of the no action alternative. That is, by not adopting the no-take regulations, the costs are avoided. Similarly, any benefits from imposing the no take regulations, for any given alternative with no take regulations, would be the costs of the no-action alternative. That is, by not adopting the no take regulations, the costs are the benefits lost by not adopting the no take regulations. Said another way, these are opportunities lost. The impacts of the no action alternative can only be understood by comparing it to one of the proposed alternatives. Thus the impacts of the no action alternative can be obtained by reading the impacts from any of the proposed alternatives in reverse.

The Preferred Alternative. The aggregate maximum potential loss to income for all recreational consumptive activities is about $4.3 million dollars or 17.2% of the income generated by recreational consumptive activities in the study area (See Table 2.30). The magnitude of impact varies by activity depending upon whether it is expressed in terms of direct usage (person-days) or economic impact (i.e. income). In terms of person-days, the activity that is most impacted is private boat fishing with a maximum potential loss of 36,381 person-days, followed by charter/party boat fishing with 25,767 person-days, private boat diving with 12,182 person-days and charter/party boat diving with 3,579 person-days. In terms of total income, the activity that is most impacted is charter/party boat fishing with a maximum potential loss of $2.7 million, followed by private boat fishing with $743 thousand, charter/party boat diving with $506 thousand and private boat diving with $309 thousand.

Table 2.30. Summary: Recreation Consumptive Activities - Preferred Alternative - Step 1 Analysis

	Total	State Waters		Federal Waters	
Person-days	77,908	63,322	81.3%	14,586	18.7%
Market Impact					
Direct Sales	$ 6,139,074	$ 4,824,499	78.6%	$ 1,314,575	21.4%
Direct Wages and Salaries	$ 2,429,728	$ 1,876,605	77.2%	$ 553,123	22.8%
Direct Employment	76	59	78.0%	17	22.0%
Total Income					
Upper Bound	$ 4,252,025	$ 3,284,059	77.2%	$ 967,966	22.8%
Lower Bound	$ 3,644,593	$ 2,814,908	77.2%	$ 829,685	22.8%
Total Employment					
Upper Bound	114	89	78.0%	25	22.0%
Lower Bound	95	74	78.0%	21	22.0%
Non-Market Impact					
Consumer's Surplus	$ 902,077	$ 733,184	81.3%	$ 168,893	18.7%
Profit[1]	$ 70,419	$ 52,125	74.0%	$ 18,294	26.0%

1. Profit is used as a proxy for producer's surplus.

Table 2.31. Recreation Consumptive Activities - Preferred Alternative - Total - Step 1 Analysis

	Charter Boat Fishing		Charter Boat Diving		Private Boat Fishing		Private Boat Diving	
	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area
Person-days	25,767	16.23%	3,579	19.95%	36,381	17.00%	12,182	25.81%
Market Impact								
Direct Sales	$ 3,354,260	16.25%	$ 603,913	20.07%	$ 1,510,907	17.00%	$ 669,994	25.81%
Direct Wages and Salaries	$ 1,539,350	16.25%	$ 289,218	19.96%	$ 424,830	17.00%	$ 176,330	25.80%
Direct Employment	45	16.35%	10	19.95%	14	16.77%	6	26.33%
Total Income								
Upper Bound	$ 2,693,862	15.83%	$ 506,132	18.70%	$ 743,453	16.63%	$ 308,578	23.90%
Lower Bound	$ 2,309,024	15.92%	$ 433,827	18.96%	$ 637,245	16.71%	$ 264,496	24.29%
Total Employment								
Upper Bound	68	15.90%	14	18.90%	22	16.77%	9	24.30%
Lower Bound	57	16.05%	12	19.00%	18	16.84%	8	24.68%
Non-Market Impact								
Consumer's Surplus	$ 298,345	16.23%	$ 41,435	19.95%	$ 421,248	17.00%	$ 141,049	25.81%
Profit[1]	$ 61,443	16.33%	$ 8,977	20.40%	n/a	n/a	n/a	n/a

1. Profit is used as a proxy for producer's surplus.

Reserve Types. The Preferred Alternative includes 12 individual reserve sites (see Appendix G for an analysis by reserve), with three types of reserves. Ten of these reserves are “Marine Reserves,” which are *no-take areas*, meaning that consumptive activity of any kind is prohibited. One of the reserves, Anacapa Island, is a “Marine Conservation Area.” This type of reserve allows for the taking of spiny lobster (*panulirus interruptus*) and pelagic finfish. Although recreational fishing or consumptive diving data were not collected by species, the Recreational Fisheries Information Network (RecFIN) fishing location add-on to the Marine Recreational Fisheries Statistics Survey (MRFSS) was used to estimate the proportion of recreational pelagic finfish by California Department of Fish and Game (CDFG) fish block. Using this proportion to eliminate pelagic finfish from the analysis, the model only takes into account prohibited species of finfish for this alternative. Unfortunately, the sample did not include data for recreational take of spiny lobster. As a result, this analysis may be an overestimate of actual maximum potential impact. The final reserve type is “Marine Park.” One of the reserves, Painted Cave, falls in to this category. In this reserve no consumptive activities are permitted except for the recreational take of spiny lobster. As was stated above, the data do not include specific information on the distribution of spiny lobster, therefore this analysis may be an overestimate of actual maximum potential impact.

Preferred Alternative: Breakout by Jurisdiction. Although just over half of the Preferred Alternative lies in state waters, a much higher percentage of consumptive activities take place within the state boundary. Overall, 81.3% of consumptive use, in terms of person-days, takes place in state waters (i.e., areas that are more shallow and closer to shore). Not surprisingly, a higher percentage of diving takes place in state waters (90.4% and 95.4% of charter/party boat and private boat diving, respectively). The proportion of charter/party boat fishing that takes place in state waters is less than the overall percentage (71.1%), while

the proportion of private boat fishing is just over the overall proportion (82.9%). See Tables 2.32 and 2.33 for details.

Table 2.32. Recreation Consumptive Activities - Preferred Alternative - State Waters - Step 1 Analysis

	Charter Boat Fishing		Charter Boat Diving		Private Boat Fishing		Private Boat Diving	
	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area
Person-days	18,312	11.53%	3,236	18.05%	30,148	14.09%	11,625	24.63%
Market Impact								
Direct Sales	$ 2,387,756	11.57%	$ 545,336	18.12%	$ 1,252,048	14.09%	$ 639,359	24.63%
Direct Wages and Salaries	$ 1,094,442	11.55%	$ 261,768	18.06%	$ 352,032	14.09%	$ 168,364	24.63%
Direct Employment	32	11.68%	9	18.06%	12	13.96%	6	24.91%
Total Income								
Upper Bound	$ 1,915,274	11.55%	$ 458,094	18.06%	$ 616,055	14.09%	$ 294,636	24.63%
Lower Bound	$ 1,641,663	11.55%	$ 392,652	18.06%	$ 528,047	14.09%	$ 252,545	24.63%
Total Employment								
Upper Bound	49	11.66%	13	18.06%	18	14.07%	9	24.92%
Lower Bound	41	11.67%	11	18.06%	15	14.03%	8	24.51%
Non-Market Impact								
Consumer's Surplus	$ 212,035	11.53%	$ 37,472	18.05%	$ 349,077	14.09%	$ 134,600	24.63%
Profit[1]	$ 44,074	11.71%	$ 8,051	18.30%	n/a	n/a	n/a	n/a

1. Profit is used as a proxy for producer's surplus.

Table 2.33. Recreation Consumptive Activities - Preferred Alternative - Federal Waters - Step 1 Analysis

	Charter Boat Fishing		Charter Boat Diving		Private Boat Fishing		Private Boat Diving	
	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area
Person-days	7,454	4.69%	342	1.91%	6,233	2.91%	557	1.18%
Market Impact								
Direct Sales	$ 966,504	4.68%	$ 58,577	1.95%	$ 258,860	2.91%	$ 30,635	1.18%
Direct Wages and Salaries	$ 444,907	4.70%	$ 27,450	1.89%	$ 72,799	2.91%	$ 7,967	1.17%
Direct Employment	13	4.67%	1	1.89%	2	2.89%	0	1.19%
Total Income								
Upper Bound	$ 778,588	4.70%	$ 48,038	1.89%	$ 127,398	2.91%	$ 13,942	1.17%
Lower Bound	$ 667,361	4.70%	$ 41,176	1.89%	$ 109,198	2.91%	$ 11,950	1.17%
Total Employment								
Upper Bound	19	4.66%	1	1.89%	4	2.91%	0	1.19%
Lower Bound	16	4.66%	1	1.89%	3	2.90%	0	1.17%
Non-Market Impact								
Consumer's Surplus	$ 86,310	4.69%	$ 3,963	1.91%	$ 72,171	2.91%	$ 6,449	1.18%
Profit[1]	$ 17,369	4.62%	$ 925	2.10%	n/a	n/a	n/a	n/a

1. Profit is used as a proxy for producer's surplus.

Alternative 1. In terms of impact on consumptive activities this is the least costly marine reserve alternative. It is significantly smaller that the preferred alternative in terms of both market and non-market impacts. The aggregate maximum potential loss to income for all consumptive recreation activities is about $2.4 million dollars or 9.7% of the income generated by recreational consumptive activities in the study area (See Table 2.34). The magnitude of impact varies by activity depending upon whether it is expressed in terms of direct usage (person-days) or economic impact (e.g. income). In terms of person-days, the activity that is most impacted is private boat fishing with a maximum potential loss of 20,469 person-days, followed by charter/party boat fishing with 16,345 person-days, private boat diving with 2,409 person-days and charter/party boat diving with 1,456 person-days. In terms of total income, the activity that is most impacted is charter/party boat fishing with a maximum potential loss of $1.7 million, followed by private boat fishing with $418 thousand, charter/party boat diving with $203 thousand and private boat diving with $61 thousand.

Table 2.34. Summary: Recreation Consumptive Activities - Alternative 1 - Step 1 Analysis

	Total	State Waters		Federal Waters	
Person-days	40,679	32,585	80.1%	8,093	19.9%
Market Impact					
Direct Sales	$3,352,951	$2,682,838	80.0%	$ 670,114	20.0%
Direct Wages and Salaries	$1,372,910	$1,097,074	79.9%	$ 275,836	20.1%
Direct Employment	43	34	80.4%	8	19.6%
Total Income					
Upper Bound	$2,402,592	$1,919,879	79.9%	$ 482,713	20.1%
Lower Bound	$2,059,364	$1,645,610	79.9%	$ 413,754	20.1%
Total Employment					
Upper Bound	64	51	80.4%	13	19.6%
Lower Bound	53	43	80.4%	10	19.6%
Non-Market Impact					
Consumer's Surplus	$ 471,006	$ 377,296	80.1%	$ 93,711	19.9%
Profit[1]	$ 42,086	$ 33,439	79.5%	$ 8,647	20.5%

1. Profit is used as a proxy for producer's surplus.

Table 2.35. Recreation Consumptive Activities - Alternative 1 - Total - Step 1 Analysis

	Charter Boat Fishing		Charter Boat Diving		Private Boat Fishing		Private Boat Diving	
	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area
Person-days	16,345	10.29%	1,456	8.12%	20,469	9.56%	2,409	5.10%
Market Impact								
Direct Sales	$ 2,131,987	10.33%	$ 238,408	7.92%	$ 850,074	9.56%	$ 132,482	5.10%
Direct Wages and Salaries	$ 983,138	10.38%	$ 115,823	7.99%	$ 239,051	9.56%	$ 34,897	5.11%
Direct Employment	29	10.54%	4	8.27%	8	9.48%	1	5.20%
Total Income								
Upper Bound	$ 1,720,492	10.11%	$ 202,691	7.49%	$ 418,340	9.36%	$ 61,069	4.73%
Lower Bound	$ 1,474,708	10.17%	$ 173,735	7.59%	$ 358,577	9.40%	$ 52,345	4.81%
Total Employment								
Upper Bound	44	10.25%	6	7.83%	12	9.41%	2	4.80%
Lower Bound	37	10.35%	5	7.87%	10	9.44%	2	4.95%
Non-Market Impact								
Consumer's Surplus	$ 189,256	10.29%	$ 16,856	8.12%	$ 237,004	9.56%	$ 27,890	5.10%
Profit[1]	$ 38,674	10.28%	$ 3,412	7.75%	n/a	n/a	n/a	n/a

1. Profit is used as a proxy for producer's surplus.

Alternative 1: Breakout by Jurisdiction. The proportion of consumptive usage in the state waters of Alternative 1 is similar to the proportion of the Preferred Alternative consumptive usage taking place within state waters. Overall, 80.1% of consumptive usage, in terms of person-days, takes place in state waters. A higher percentage of diving takes place in state waters (91.8% and 92.5% of charter/party boat and private boat diving, respectively). The percentage of fishing that takes place in state waters is less than the overall percentage of fishing (78% and 79.5 percent of charter/party boat and private boat respectively). See Tables 2.36 and 2.37 for details.

Table 2.36. Recreation Consumptive Activities - Alternative 1 - State Waters - Step 1 Analysis

	Charter Boat Fishing		Charter Boat Diving		Private Boat Fishing		Private Boat Diving	
	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area
Person-days	12,752	8.03%	1,337	7.46%	16,267	7.60%	2,229	4.72%
Market Impact								
Direct Sales	$ 1,666,068	8.07%	$ 218,625	7.27%	$ 675,571	7.60%	$ 122,574	4.72%
Direct Wages and Salaries	$ 768,553	8.11%	$ 106,221	7.33%	$ 189,973	7.60%	$ 32,327	4.73%
Direct Employment	23	8.29%	4	7.60%	6	7.54%	1	4.81%
Total Income								
Upper Bound	$ 1,344,968	8.11%	$ 185,887	7.33%	$ 332,452	7.60%	$ 56,572	4.73%
Lower Bound	$ 1,152,829	8.11%	$ 159,332	7.33%	$ 284,959	7.60%	$ 48,490	4.73%
Total Employment								
Upper Bound	35	8.27%	5	7.60%	10	7.60%	2	4.81%
Lower Bound	29	8.27%	5	7.60%	8	7.57%	1	4.73%
Non-Market Impact								
Consumer's Surplus	$ 147,657	8.03%	$ 15,482	7.46%	$ 188,352	7.60%	$ 25,805	4.72%
Profit[1]	$ 30,310	8.05%	$ 3,130	7.11%	n/a	n/a	n/a	n/a

1. Profit is used as a proxy for producer's surplus.

Table 2.37. Recreation Consumptive Activities - Alternative 1 - Federal Waters - Step 1 Analysis

	Charter Boat Fishing		Charter Boat Diving		Private Boat Fishing		Private Boat Diving	
	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area
Person-days	3,593	2.26%	119	0.66%	4,202	1.96%	180	0.38%
Market Impact								
Direct Sales	$ 465,919	2.26%	$ 19,783	0.66%	$ 174,503	1.96%	$ 9,908	0.38%
Direct Wages and Salaries	$ 214,585	2.26%	$ 9,602	0.66%	$ 49,078	1.96%	$ 2,570	0.38%
Direct Employment	6	2.25%	0	0.67%	2	1.95%	0	0.39%
Total Income								
Upper Bound	$ 375,524	2.26%	$ 16,804	0.66%	$ 85,887	1.96%	$ 4,498	0.38%
Lower Bound	$ 321,878	2.26%	$ 14,403	0.66%	$ 73,618	1.96%	$ 3,855	0.38%
Total Employment								
Upper Bound	9	2.25%	0	0.67%	2	1.96%	0	0.39%
Lower Bound	8	2.25%	0	0.67%	2	1.96%	0	0.38%
Non-Market Impact								
Consumer's Surplus	$ 41,598	2.26%	$ 1,374	0.66%	$ 48,652	1.96%	$ 2,086	0.38%
Profit[1]	$ 8,364	2.22%	$ 283	0.64%	n/a	n/a	n/a	n/a

1. Profit is used as a proxy for producer's surplus.

One other important point to mention is that due to there not being a reserve in the Santa Barbara region of the study area, the impact of this alternative on Los Angeles County will be lower (7% in terms of person-days of activity). Because of the distance to the distance to San Miguel, Santa Rosa, Santa Cruz, and Anacapa Islands, the relative proximity of Santa Barbara Island makes it the primary destination of consumptive recreational users from Los Angeles County. The maximum potential loss to this group of users, will therefore be less than it will be for other groups of recreational fishers.

Alternative 2. In terms of impact on consumptive activities Alternative 2 is slightly smaller than the preferred marine reserve alternative. The aggregate maximum potential loss to income for all consumptive activities is about $3.9 million dollars or 15.8% of the income generated by recreational consumptive activity in the study area (See Table 2.38). The magnitude of impact varies by activity depending upon whether it is expressed in terms of direct usage (person-days) or economic impact (e.g. income). In terms of person-days, the activity that is most impacted is private boat fishing with a maximum potential loss of 33,956 person-days, followed by charter/party boat fishing with 22,981 person-days, private boat diving with 11,299 person-days and charter/party boat diving with 3,639 person-days. In terms of total income, the activity that is most impacted is charter/party boat fishing with a maximum potential loss of $2.4 million, followed by private boat fishing with $694 thousand, charter/party boat diving with $520 thousand and private boat diving with $286 thousand.

Table 2.38. Summary: Recreation Consumptive Activities - Alternative 2 - Step 1 Analysis

	Total	State Waters		Federal Waters	
Person-days	71,875	59,451	82.7%	12,424	17.3%
Market Impact					
Direct Sales	$ 5,632,831	$ 4,527,946	80.4%	$ 1,104,886	19.6%
Direct Wages and Salaries	$ 2,234,694	$ 1,769,845	79.2%	$ 464,849	20.8%
Direct Employment	70	56	80.0%	14	20.0%
Total Income					
Upper Bound	$ 3,910,714	$ 3,097,229	79.2%	$ 813,485	20.8%
Lower Bound	$ 3,352,040	$ 2,654,767	79.2%	$ 697,273	20.8%
Total Employment					
Upper Bound	105	84	80.0%	21	20.0%
Lower Bound	87	70	80.0%	17	20.0%
Non-Market Impact					
Consumer's Surplus	$ 832,222	$ 688,366	82.7%	$ 143,856	17.3%
Profit[1]	$ 62,683	$ 47,436	75.7%	$ 15,247	24.3%

1. Profit is used as a proxy for producer's surplus.

Table 2.39. Recreation Consumptive Activities - Alternative 2 - Total - Step 1 Analysis

	Charter Boat Fishing		Charter Boat Diving		Private Boat Fishing		Private Boat Diving	
	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area
Person-days	22,981	14.47%	3,639	20.29%	33,956	15.87%	11,299	23.94%
Market Impact								
Direct Sales	$ 2,988,969	14.48%	$ 612,212	20.35%	$ 1,410,210	15.87%	$ 621,440	23.94%
Direct Wages and Salaries	$ 1,377,478	14.54%	$ 297,005	20.50%	$ 396,555	15.87%	$ 163,656	23.95%
Direct Employment	41	14.62%	10	20.35%	13	15.65%	6	24.43%
Total Income								
Upper Bound	$ 2,410,587	14.16%	$ 519,759	19.20%	$ 693,971	15.52%	$ 286,397	22.18%
Lower Bound	$ 2,066,217	14.24%	$ 445,508	19.47%	$ 594,832	15.60%	$ 245,483	22.55%
Total Employment								
Upper Bound	61	14.21%	15	19.28%	20	15.65%	9	22.55%
Lower Bound	51	14.35%	12	19.38%	17	15.72%	7	22.90%
Non-Market Impact								
Consumer's Surplus	$ 266,086	14.47%	$ 42,136	20.29%	$ 393,173	15.87%	$ 130,827	23.94%
Profit[1]	$ 53,942	14.34%	$ 8,741	19.86%	n/a	n/a	n/a	n/a

1. Profit is used as a proxy for producer's surplus.

Alternative 2: Breakout by Jurisdiction. About 67% of Alternative 2 lies in state waters, although a higher percentage of fishing and a significantly higher percentage of diving occurs within the state boundary. Overall, 82.7% of consumptive usage, in terms of person-days, takes place in state waters. A higher percentage of diving takes place in state waters (90.4% and 95.4% of charter/party boat and private boat diving, respectively). The proportion of charter/party boat fishing is less than the overall percentage (71.1%) and the proportion of private boat fishing is slightly higher than the overall percentage (82.9%). See Table 2.40 and 2.41 for details.

Table 2.40. Recreation Consumptive Activities - Alternative 2 - State Waters - Step 1 Analysis

	Charter Boat Fishing		Charter Boat Diving		Private Boat Fishing		Private Boat Diving	
	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area
Person-days	16,615	10.46%	3,447	19.22%	28,385	13.26%	11,004	23.32%
Market Impact								
Direct Sales	$ 2,164,101	10.49%	$ 579,796	19.27%	$ 1,178,848	13.26%	$ 605,200	23.32%
Direct Wages and Salaries	$ 997,646	10.53%	$ 281,282	19.41%	$ 331,484	13.26%	$ 159,432	23.33%
Direct Employment	30	10.64%	9	19.28%	11	13.15%	6	23.59%
Total Income								
Upper Bound	$ 1,745,881	10.53%	$ 492,244	19.41%	$ 580,097	13.26%	$ 279,006	23.33%
Lower Bound	$ 1,496,469	10.53%	$ 421,924	19.41%	$ 497,226	13.26%	$ 239,148	23.33%
Total Employment								
Upper Bound	44	10.62%	14	19.28%	17	13.25%	9	23.59%
Lower Bound	37	10.63%	12	19.28%	14	13.21%	7	23.20%
Non-Market Impact								
Consumer's Surplus	$ 192,375	10.46%	$ 39,914	19.22%	$ 328,668	13.26%	$ 127,408	23.32%
Profit[1]	$ 39,158	10.41%	$ 8,279	18.81%	n/a	n/a	n/a	n/a

1. Profit is used as a proxy for producer's surplus.

Table 2.41. Recreation Consumptive Activities - Alternative 2 - Federal Waters - Step 1 Analysis

	Charter Boat Fishing		Charter Boat Diving		Private Boat Fishing		Private Boat Diving	
	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area
Person-days	6,366	4.01%	192	1.07%	5,571	2.60%	295	0.63%
Market Impact								
Direct Sales	$ 824,868	4.00%	$ 32,416	1.08%	$ 231,362	2.60%	$ 16,239	0.63%
Direct Wages and Salaries	$ 379,832	4.01%	$ 15,723	1.09%	$ 65,071	2.60%	$ 4,224	0.62%
Direct Employment	11	3.98%	1	1.07%	2	2.58%	0	0.63%
Total Income								
Upper Bound	$ 664,706	4.01%	$ 27,515	1.09%	$ 113,874	2.60%	$ 7,391	0.62%
Lower Bound	$ 569,748	4.01%	$ 23,584	1.09%	$ 97,606	2.60%	$ 6,335	0.62%
Total Employment								
Upper Bound	17	3.97%	1	1.07%	3	2.60%	0	0.63%
Lower Bound	14	3.97%	1	1.07%	3	2.59%	0	0.62%
Non-Market Impact								
Consumer's Surplus	$ 73,711	4.01%	$ 2,222	1.07%	$ 64,505	2.60%	$ 3,419	0.63%
Profit[1]	$ 14,784	3.93%	$ 463	1.05%	n/a	n/a	n/a	n/a

1. Profit is used as a proxy for producer's surplus.

Because this alternative does not have a reserve in the Santa Barbara region, one would expect the impact of this alternative on Los Angeles County users to be lower. Because of the distance to San Miguel, Santa Rosa, Santa Cruz, and Anacapa Islands, the relative proximity of Santa Barbara Island makes it the primary destination of consumptive recreational users from Los Angeles County. However, because this alternative encompasses the entire region in which users from Los Angeles operate, and users from Los Angeles do operate in the proximity of Santa Cruz and Anacapa Islands, the relative impacts to Los Angeles County and the study area in general are similar (about 16% in terms of person-days).

Reserve Types. The Alternative 2 includes 11 individual reserve sites, with two types of reserves. Eight of these reserves are Marine Reserves. Three of the reserves, Carrington Point, Scorpion (East and West), and Anacapa Island, are Marine Conservation Areas. This type of reserve allows for the taking of spiny lobster and pelagic finfish. Although recreational fishing or consumptive diving data by species was not collected, the RecFIN fishing location add-on to the MRFSS was used to estimate the proportion of recreational pelagic finfish by CDFG fish block. Using this proportion to eliminate pelagic finfish from the analysis, the model only takes into account prohibited species of finfish for these reserves. Unfortunately, the sample did not include data for recreational taking of spiny lobsters. As a result, this analysis may be an overestimate of actual maximum potential impact.

Alternative 3. In terms of impact on consumptive activities Alternative 3 is smaller than the preferred marine reserve alternative. The aggregate maximum potential loss to income for all consumptive activities is about $2.9 million dollars or 11.6% of the income generated by recreational consumptive activity in the study area (See Table 2.42). The magnitude of impact varies by activity depending upon whether it is expressed in terms of direct usage (person-days) or economic impact (e.g. income). In terms of person-days, the activity that is most impacted is private boat fishing with a maximum potential loss of 21,890 person-days, followed by charter/party boat fishing with 20,028 person-days, private boat diving with 2,667 person-days and charter/party boat diving with 1,689 person-days. In terms of total income, the activity that is most impacted is charter/party boat fishing with a maximum potential loss of $2.1 million, followed by private boat fishing with $447 thousand, charter/party boat diving with $236 thousand and private boat diving with $68 thousand.

Table 2.42. Summary: Recreation Consumptive Activities - Alternative 3 - Step 1 Analysis

	Total	State Waters		Federal Waters	
Person-days	46,273	34,113	73.7%	12,160	26.3%
Market Impact					
Direct Sales	$ 3,943,786	$ 2,800,674	71.0%	$ 1,143,113	29.0%
Direct Wages and Salaries	$ 1,632,707	$ 1,143,952	70.1%	$ 488,756	29.9%
Direct Employment	50	36	71.0%	15	29.0%
Total Income					
Upper Bound	$ 2,857,238	$ 2,001,916	70.1%	$ 855,322	29.9%
Lower Bound	$ 2,449,061	$ 1,715,928	70.1%	$ 733,133	29.9%
Total Employment					
Upper Bound	76	54	71.0%	22	29.0%
Lower Bound	63	45	71.0%	18	29.0%
Non-Market Impact					
Consumer's Surplus	$ 535,789	$ 394,989	73.7%	$ 140,800	26.3%
Profit[1]	$ 51,263	$ 34,738	67.8%	$ 16,525	32.2%

1. Profit is used as a proxy for producer's surplus.

Table 2.43. Recreation Consumptive Activities - Alternative 3 - Total - Step 1 Analysis

	Charter Boat Fishing		Charter Boat Diving		Private Boat Fishing		Private Boat Diving	
	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area
Person-days	20,028	12.61%	1,689	9.42%	21,890	10.23%	2,667	5.65%
Market Impact								
Direct Sales	$ 2,610,434	12.65%	$ 277,598	9.23%	$ 909,087	10.23%	$ 146,667	5.65%
Direct Wages and Salaries	$ 1,203,580	12.70%	$ 134,838	9.31%	$ 255,649	10.23%	$ 38,641	5.65%
Direct Employment	36	12.87%	5	9.57%	9	10.09%	1	5.80%
Total Income								
Upper Bound	$ 2,106,265	12.38%	$ 235,967	8.72%	$ 447,385	10.01%	$ 67,621	5.24%
Lower Bound	$ 1,805,370	12.45%	$ 202,257	8.84%	$ 383,473	10.06%	$ 57,961	5.32%
Total Employment								
Upper Bound	54	12.51%	7	9.07%	13	10.09%	2	5.36%
Lower Bound	45	12.64%	6	9.12%	11	10.14%	2	5.44%
Non-Market Impact								
Consumer's Surplus	$ 231,895	12.61%	$ 19,560	9.42%	$ 253,457	10.23%	$ 30,877	5.65%
Profit[1]	$ 47,291	12.57%	$ 3,972	9.03%	n/a	n/a	n/a	n/a

1. Profit is used as a proxy for producer's surplus.

Alternative 3: Breakout by Jurisdiction. Although about 59% of Alternative 3 lies in state waters, almost 74% of consumptive usage, in terms of person-days, takes place in state waters. Like Alternatives 1 and 2, a higher percentage of diving takes place in state waters (85.6% and 89.6% of charter/party boat and private boat diving, respectively). The percentage of charter/party boat fishing that takes place in state waters is less than the overall percentage of fishing (65.8%) while for private boat fishing, the percentage taking place in state waters is greater than the overall proportion (78.1%). See Tables 2.44 and 2.45 for details.

Table 2.44. Recreation Consumptive Activities - Alternative 3 - State Waters - Step 1 Analysis

	Charter Boat Fishing		Charter Boat Diving		Private Boat Fishing		Private Boat Diving	
	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area
Person-days	13,180	8.30%	1,446	8.06%	17,098	7.99%	2,390	5.06%
Market Impact								
Direct Sales	$ 1,722,352	8.35%	$ 236,790	7.87%	$ 710,081	7.99%	$ 131,451	5.06%
Direct Wages and Salaries	$ 794,563	8.39%	$ 115,036	7.94%	$ 199,680	7.99%	$ 34,672	5.07%
Direct Employment	24	8.57%	4	8.21%	7	7.92%	1	5.16%
Total Income								
Upper Bound	$ 1,390,486	8.39%	$ 201,313	7.94%	$ 349,440	7.99%	$ 60,677	5.07%
Lower Bound	$ 1,191,845	8.39%	$ 172,554	7.94%	$ 299,520	7.99%	$ 52,009	5.07%
Total Employment								
Upper Bound	36	8.55%	6	8.21%	10	7.98%	2	5.16%
Lower Bound	30	8.56%	5	8.21%	8	7.96%	2	5.08%
Non-Market Impact								
Consumer's Surplus	$ 152,604	8.30%	$ 16,738	8.06%	$ 197,974	7.99%	$ 27,673	5.06%
Profit[1]	$ 31,349	8.33%	$ 3,389	7.70%	n/a	n/a	n/a	n/a

1. Profit is used as a proxy for producer's surplus.

Table 2.45. Recreation Consumptive Activities - Alternative 3 - Federal Waters - Step 1 Analysis

	Charter Boat Fishing		Charter Boat Diving		Private Boat Fishing		Private Boat Diving	
	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area
Person-days	6,848	4.31%	244	1.36%	4,792	2.24%	277	0.59%
Market Impact								
Direct Sales	$ 888,082	4.30%	$ 40,808	1.36%	$ 199,005	2.24%	$ 15,217	0.59%
Direct Wages and Salaries	$ 409,017	4.32%	$ 19,802	1.37%	$ 55,968	2.24%	$ 3,968	0.58%
Direct Employment	12	4.30%	1	1.37%	2	2.22%	0	0.59%
Total Income								
Upper Bound	$ 715,779	4.32%	$ 34,654	1.37%	$ 97,945	2.24%	$ 6,944	0.58%
Lower Bound	$ 613,525	4.32%	$ 29,703	1.37%	$ 83,952	2.24%	$ 5,952	0.58%
Total Employment								
Upper Bound	18	4.29%	1	1.37%	3	2.24%	0	0.59%
Lower Bound	15	4.29%	1	1.37%	2	2.23%	0	0.58%
Non-Market Impact								
Consumer's Surplus	$ 79,291	4.31%	$ 2,822	1.36%	$ 55,484	2.24%	$ 3,204	0.59%
Profit[1]	$ 15,942	4.24%	$ 583	1.32%	n/a	n/a	n/a	n/a

1. Profit is used as a proxy for producer's surplus.

One other important point to mention is that due to there not being a reserve in the Santa Barbara region of the study area, the impact of this alternative on Los Angeles County will be lower (8% in terms of person-days of activity). Because of the distance to San Miguel, Santa Rosa, Santa Cruz, and Anacapa Islands, the relative proximity of Santa Barbara Island makes it the primary destination of consumptive recreational users from Los Angeles County. The maximum potential loss to this group of users, will therefore be less.

Alternative 4. In terms of impact on consumptive activities Alternative 4 is larger than the preferred marine reserve alternative. The aggregate maximum potential loss to income for all consumptive activities is about $5 million dollars or 20.3% of the income generated by recreational consumptive activities in the study area (See Table 2.46). The magnitude of impact varies by activity depending upon whether it is expressed in terms of direct usage (person-days) or economic impact (e.g. income). In terms of person-days, the activity that is most impacted is private boat fishing with a maximum potential loss of 40,660 person-days, followed by charter/party boat fishing with 31,962 person-days, private boat diving with 12,088 person-days and charter/party boat diving with 3,751 person-days. In terms of total income, the activity that is most impacted is charter/party boat fishing with a maximum potential loss of $3.3 million, followed by private boat fishing with $831 thousand, charter/party boat diving with $531 thousand and private boat diving with $306 thousand.

Table 2.46. Summary: Recreation Consumptive Activities - Alternative 4 - Step 1 Analysis

	Total	State Waters		Federal Waters	
Person-days	88,462	69,182	78.2%	19,279	21.8%
Market Impact					
Direct Sales	$ 7,142,126	$ 5,298,977	74.2%	$ 1,843,149	25.8%
Direct Wages and Salaries	$ 2,862,600	$ 2,070,691	72.3%	$ 791,910	27.7%
Direct Employment	89	65	73.4%	24	26.6%
Total Income					
Upper Bound	$ 5,009,550	$ 3,623,708	72.3%	$ 1,385,842	27.7%
Lower Bound	$ 4,293,900	$ 3,106,036	72.3%	$ 1,187,865	27.7%
Total Employment					
Upper Bound	133	98	73.4%	35	26.6%
Lower Bound	111	82	73.4%	29	26.6%
Non-Market Impact					
Consumer's Surplus	$ 1,024,276	$ 801,044	78.2%	$ 223,232	21.8%
Profit[1]	$ 85,268	$ 58,280	68.3%	$ 26,988	31.7%

1. Profit is used as a proxy for producer's surplus.

Table 2.47. Recreation Consumptive Activities - Alternative 4 - Total - Step 1 Analysis

	Charter Boat Fishing		Charter Boat Diving		Private Boat Fishing		Private Boat Diving	
	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area
Person-days	31,962	20.13%	3,751	20.92%	40,660	19.00%	12,088	25.62%
Market Impact								
Direct Sales	$ 4,159,819	20.16%	$ 628,832	20.90%	$ 1,688,613	19.00%	$ 664,862	25.62%
Direct Wages and Salaries	$ 1,909,430	20.15%	$ 303,296	20.93%	$ 474,802	19.00%	$ 175,073	25.62%
Direct Employment	56	20.27%	10	21.01%	16	18.74%	6	26.15%
Total Income								
Upper Bound	$ 3,341,502	19.63%	$ 530,767	19.61%	$ 830,904	18.58%	$ 306,377	23.73%
Lower Bound	$ 2,864,145	19.75%	$ 454,944	19.89%	$ 712,203	18.67%	$ 262,609	24.12%
Total Employment								
Upper Bound	85	19.70%	15	19.90%	24	18.74%	9	24.14%
Lower Bound	70	19.90%	13	20.01%	20	18.83%	8	24.52%
Non-Market Impact								
Consumer's Surplus	$ 370,078	20.13%	$ 43,437	20.92%	$ 470,793	19.00%	$ 139,968	25.62%
Profit[1]	$ 76,111	20.23%	$ 9,157	20.81%	n/a	n/a	n/a	n/a

1. Profit is used as a proxy for producer's surplus.

Alternative 4: Breakout by Jurisdiction. Like the preferred alternative, about half of Alternative 4 lies in state waters, however, 78.2% of overall consumptive usage, in terms of person-days, takes place in state waters. A higher percentage of diving (89.8% and 96.9% of charter/party boat and private boat diving, respectively) and private boat fishing (82.1%) takes place in state waters, while the proportion of charter/party boat fishing (64.8%) is lower than the overall percentage. See Table 2.48 and 2.49 for details.

Table 2.48. Recreation Consumptive Activities - Alternative 4 - State Waters - Step 1 Analysis

	Charter Boat Fishing		Charter Boat Diving		Private Boat Fishing		Private Boat Diving	
	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area
Person-days	20,726	13.05%	3,368	18.78%	33,373	15.59%	11,716	24.83%
Market Impact								
Direct Sales	$ 2,704,517	13.10%	$ 564,107	18.75%	$ 1,385,993	15.59%	$ 644,360	24.83%
Direct Wages and Salaries	$ 1,239,357	13.08%	$ 271,899	18.76%	$ 389,711	15.59%	$ 169,724	24.83%
Direct Employment	37	13.26%	9	18.87%	13	15.46%	6	25.13%
Total Income								
Upper Bound	$ 2,168,875	13.08%	$ 475,823	18.76%	$ 681,994	15.59%	$ 297,016	24.83%
Lower Bound	$ 1,859,036	13.08%	$ 407,848	18.76%	$ 584,566	15.59%	$ 254,585	24.83%
Total Employment								
Upper Bound	55	13.23%	14	18.87%	20	15.58%	9	25.13%
Lower Bound	46	13.24%	11	18.87%	17	15.53%	8	24.72%
Non-Market Impact								
Consumer's Surplus	$ 239,979	13.05%	$ 38,992	18.78%	$ 386,421	15.59%	$ 135,653	24.83%
Profit[1]	$ 50,046	13.30%	$ 8,233	18.71%	n/a	n/a	n/a	n/a

1. Profit is used as a proxy for producer's surplus.

Table 2.49. Recreation Consumptive Activities - Alternative 4 - Federal Waters - Step 1 Analysis

	Charter Boat Fishing		Charter Boat Diving		Private Boat Fishing		Private Boat Diving	
	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area
Person-days	11,236	7.08%	384	2.14%	7,287	3.40%	373	0.79%
Market Impact								
Direct Sales	$ 1,455,302	7.05%	$ 64,726	2.15%	$ 302,620	3.40%	$ 20,501	0.79%
Direct Wages and Salaries	$ 670,072	7.07%	$ 31,397	2.17%	$ 85,091	3.40%	$ 5,349	0.78%
Direct Employment	19	7.01%	1	2.14%	3	3.38%	0	0.79%
Total Income								
Upper Bound	$ 1,172,627	7.07%	$ 54,945	2.17%	$ 148,910	3.40%	$ 9,361	0.78%
Lower Bound	$ 1,005,109	7.07%	$ 47,096	2.17%	$ 127,637	3.40%	$ 8,023	0.78%
Total Employment								
Upper Bound	29	6.99%	2	2.14%	4	3.40%	0	0.79%
Lower Bound	24	7.00%	1	2.14%	4	3.39%	0	0.78%
Non-Market Impact								
Consumer's Surplus	$ 130,099	7.08%	$ 4,445	2.14%	$ 84,372	3.40%	$ 4,316	0.79%
Profit[1]	$ 26,064	6.93%	$ 924	2.10%	n/a	n/a	n/a	n/a

1. Profit is used as a proxy for producer's surplus.

Alternative 5. In terms of impact on consumptive activities Alternative 5 is significantly larger than the preferred marine reserve alternative. The aggregate maximum potential loss to income for all consumptive activities is about $5.9 million dollars or 23.9% of the income generated in the study area (See Table 2.50). The magnitude of impact varies by activity depending upon whether it is expressed in terms of direct usage (person-days) or economic impact (e.g. income). In terms of person-days, the activity that is most impacted is private boat fishing with a maximum potential loss of 47,460 person-days, followed by charter/party boat fishing with 36,568 person-days, private boat diving with 15,341 person-days and charter/party boat diving with 5,128 person-days. In terms of total income, the activity that is most impacted is charter/party boat fishing with a maximum potential loss of $3.8 million, followed by private boat fishing with $970 thousand, charter/party boat diving with $728 thousand and private boat diving with $389 thousand.

Table 2.50. Summary: Recreation Consumptive Activities - Alternative 5 - Step 1 Analysis

	Total	State Waters		Federal Waters	
Person-days	104,497	81,716	78.2%	22,781	21.8%
Market Impact					
Direct Sales	$ 8,437,525	$ 6,289,616	74.5%	$ 2,147,909	25.5%
Direct Wages and Salaries	$ 3,378,264	$ 2,460,811	72.8%	$ 917,454	27.2%
Direct Employment	105	78	73.9%	27	26.1%
Total Income					
Upper Bound	$ 5,911,963	$ 4,306,419	72.8%	$ 1,605,544	27.2%
Lower Bound	$ 5,067,397	$ 3,691,216	72.8%	$ 1,376,181	27.2%
Total Employment					
Upper Bound	157	116	73.9%	41	26.1%
Lower Bound	131	97	73.9%	34	26.1%
Non-Market Impact					
Consumer's Surplus	$ 1,209,945	$ 946,171	78.2%	$ 263,774	21.8%
Profit[1]	$ 99,431	$ 68,324	68.7%	$ 31,107	31.3%

1. Profit is used as a proxy for producer's surplus.

Table 2.51. Recreation Consumptive Activities - Alternative 5 - Total - Step 1 Analysis

	Charter Boat Fishing		Charter Boat Diving		Private Boat Fishing		Private Boat Diving	
	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area
Person-days	36,568	23.03%	5,128	28.60%	47,460	22.18%	15,341	32.51%
Market Impact								
Direct Sales	$ 4,757,769	23.05%	$ 865,003	28.75%	$ 1,971,015	22.18%	$ 843,737	32.51%
Direct Wages and Salaries	$ 2,186,026	23.07%	$ 415,873	28.70%	$ 554,220	22.18%	$ 222,145	32.50%
Direct Employment	64	23.19%	14	28.61%	19	21.87%	8	33.18%
Total Income								
Upper Bound	$ 3,825,545	22.48%	$ 727,778	26.88%	$ 969,886	21.69%	$ 388,754	30.10%
Lower Bound	$ 3,279,039	22.61%	$ 623,810	27.27%	$ 831,331	21.80%	$ 333,218	30.61%
Total Employment								
Upper Bound	97	22.55%	21	27.10%	28	21.87%	12	30.63%
Lower Bound	81	22.77%	17	27.25%	24	21.98%	10	31.11%
Non-Market Impact								
Consumer's Surplus	$ 423,411	23.03%	$ 59,380	28.60%	$ 549,528	22.18%	$ 177,626	32.51%
Profit[1]	$ 86,727	23.05%	$ 12,704	28.87%	n/a	n/a	n/a	n/a

1. Profit is used as a proxy for producer's surplus.

Alternative 5: Breakout by Jurisdiction. Although about 54% of Alternative 5 lies in state waters, 81.3% of consumptive usage, in terms of person-days, takes place in state waters. Like Alternative 4, a higher percentage of diving (90.4% and 95.4% of charter/party boat and private boat diving, respectively) and private boat fishing (82.9%) takes place in state waters, while the proportion of charter/party boat fishing (71.1%) is lower than the overall percentage. See Tables 2.52 and 2.53 for details.

Table 2.52. Recreation Consumptive Activities - Alternative 5 - State Waters - Step 1 Analysis

	Charter Boat Fishing		Charter Boat Diving		Private Boat Fishing		Private Boat Diving	
	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area
Person-days	23,744	14.96%	4,626	25.79%	38,603	18.04%	14,744	31.24%
Market Impact								
Direct Sales	$ 3,096,409	15.00%	$ 779,126	25.90%	$ 1,603,166	18.04%	$ 810,914	31.24%
Direct Wages and Salaries	$ 1,421,247	15.00%	$ 375,186	25.89%	$ 450,785	18.04%	$ 213,593	31.25%
Direct Employment	42	15.19%	12	25.83%	15	17.88%	8	31.62%
Total Income								
Upper Bound	$ 2,487,182	15.00%	$ 656,576	25.89%	$ 788,874	18.04%	$ 373,787	31.25%
Lower Bound	$ 2,131,870	15.00%	$ 562,779	25.89%	$ 676,178	18.04%	$ 320,389	31.25%
Total Employment								
Upper Bound	63	15.15%	19	25.83%	23	18.02%	11	31.62%
Lower Bound	53	15.17%	15	25.83%	19	17.97%	10	31.11%
Non-Market Impact								
Consumer's Surplus	$ 274,926	14.96%	$ 53,560	25.79%	$ 446,970	18.04%	$ 170,716	31.24%
Profit[1]	$ 56,935	15.13%	$ 11,389	25.88%	n/a	n/a	n/a	n/a

1. Profit is used as a proxy for producer's surplus.

Table 2.53. Recreation Consumptive Activities - Alternative 5 - Federal Waters - Step 1 Analysis

	Charter Boat Fishing		Charter Boat Diving		Private Boat Fishing		Private Boat Diving	
	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area
Person-days	12,824	8.08%	503	2.80%	8,857	4.14%	597	1.26%
Market Impact								
Direct Sales	$ 1,661,360	8.05%	$ 85,877	2.85%	$ 367,849	4.14%	$ 32,823	1.26%
Direct Wages and Salaries	$ 764,779	8.07%	$ 40,687	2.81%	$ 103,435	4.14%	$ 8,553	1.25%
Direct Employment	22	8.00%	1	2.78%	4	4.10%	0	1.27%
Total Income								
Upper Bound	$ 1,338,363	8.07%	$ 71,202	2.81%	$ 181,011	4.14%	$ 14,967	1.25%
Lower Bound	$ 1,147,169	8.07%	$ 61,030	2.81%	$ 155,153	4.14%	$ 12,829	1.25%
Total Employment								
Upper Bound	33	7.98%	2	2.78%	5	4.14%	0	1.27%
Lower Bound	28	7.99%	2	2.78%	4	4.12%	0	1.25%
Non-Market Impact								
Consumer's Surplus	$ 148,485	8.08%	$ 5,820	2.80%	$ 102,558	4.14%	$ 6,910	1.26%
Profit[1]	$ 29,792	7.92%	$ 1,315	2.99%	n/a	n/a	n/a	n/a

1. Profit is used as a proxy for producer's surplus.

Table 2.54 Summary of Impacts on Consumptive Recreation - Step 1 Analysis

	State Waters		Federal Waters		Total	
Alternative	Amount	% [1]	Amount	%	Amount	%
			Person-days [2]			
1	32,585	7.4%	8,093	1.8%	40,678	9.3%
2	59,451	13.6%	12,424	2.8%	71,875	16.4%
3	34,113	7.8%	12,160	2.8%	46,273	10.6%
4	69,182	15.8%	19,279	4.4%	88,461	20.2%
5	81,716	18.7%	22,781	5.2%	104,497	23.9%
Preferred	63,322	14.5%	14,586	3.3%	77,908	17.8%
			Income [3]			
1	$1,919,879	7.8%	$482,713	2.0%	$2,402,592	9.7%
2	$3,097,229	12.5%	$813,485	3.3%	$3,910,714	15.8%
3	$2,001,916	8.1%	$855,322	3.5%	$2,857,238	11.6%
4	$3,623,708	14.7%	$1,385,842	5.6%	$5,009,550	20.3%
5	$4,306,419	17.4%	$1,605,544	6.5%	$5,911,963	23.9%
Preferred	$3,284,059	13.3%	$967,966	3.9%	$4,252,025	17.2%
			Employment [4]			
1	51	7.8%	13	2.0%	64	9.8%
2	84	12.8%	21	3.2%	105	16.1%
3	54	8.3%	22	3.4%	76	11.6%
4	98	15.0%	35	5.4%	133	20.3%
5	116	17.7%	41	6.3%	157	24.0%
Preferred	89	13.6%	25	3.8%	114	17.4%

1. Percents are the percent of total baseline amounts from the recreation data.
2. Total Person-days of consumptive activities is equal to 437,907
3. Total income, including multiplier impacts, is equal to $24,686,919
4. Total employment, including multiplier impacts, is equal to 654 jobs.

Aggregate Consumptive Impacts – Step 1 Analysis

Table 2.55 presents step 1 income and employment impacts for the sum of all consumptive activities for each alternative. Percentages in the table are of the baseline aggregate consumptive activities.

Table 2.55. Aggregate Consumptive Activities: Summary of Impacts by Alternative - Step 1 Analysis

	State Waters		Federal Waters		Total	
Alternative	Amount	% [1]	Amount	%	Amount	%
			Income [2]			
1	$7,282,841	6.8%	$877,570	0.8%	$8,160,411	7.6%
2	$8,728,618	8.1%	$1,063,077	1.0%	$9,791,695	9.1%
3	$7,658,580	7.1%	$1,352,310	1.3%	$9,010,890	8.4%
4	$14,791,844	13.7%	$2,101,516	2.0%	$16,893,360	15.7%
5	$18,144,585	16.9%	$2,418,978	2.2%	$20,563,563	19.1%
Preferred	$13,407,739	12.5%	$1,498,958	1.4%	$14,906,697	13.9%
			Employment [3]			
1	207	7.0%	25	0.8%	232	7.8%
2	245	8.3%	29	1.0%	274	9.3%
3	218	7.4%	37	1.2%	255	8.6%
4	422	14.3%	57	1.9%	479	16.2%
5	513	17.3%	66	2.2%	579	19.6%
Preferred	385	13.0%	41	1.4%	426	14.4%

1. Percents are the percent of total baseline amounts from the aggregate data.
2. Total income, including multiplier impacts, is equal to $107,600,471 (Baseline Study Area Total).
3. Total employment, including multiplier impacts, is equal to 2,961 jobs (Baseline Study Area Total).

Habitat Protection per Dollar of Impact. One way to judge the relative efficiency of marine reserve alternatives is to estimate the amount of resource protection that is derived for every dollar in income impact associated with the alternative. In a way, this estimate can be considered the "bang for the buck" derived from the alternative. This method does not take into account the type of habitat preserved or the differences among alternatives of habitats encompassed, in terms of quality or diversity, but it is a starting point in the process of integrating the protection gained from marine reserves and the impact resulting from their establishment. It should be noted that, like all of the estimates in this chapter, these calculations are based on step 1 of the analysis only.

As can be seen in Table 2.56, the highest level of protection per unit of income lost occurs under Alternative 3, with 2.51 percent of the sanctuary protected for every one percent of income impact. This is followed by Alternative 4 (1.85), the Preferred Alternative (1.80), Alternative 5 (1.78), Alternative 1 (1.58) and Alternative 2 (1.54).

Table 2.56 Habitat Protection per Dollar of Impact on Income

Alternative	Percent of Sanctuary Protected	Percent Impact on Income	Habitat Protection[1]
Alternative 1	12.0	7.6%	1.58
Alternative 2	14.0	9.1%	1.54
Alternative 3	21.0	8.4%	2.51
Alternative 4	29.0	15.7%	1.85
Alternative 5	34.0	19.1%	1.78
Preferred Alternative	25.0	13.9%	1.80

1. Calculated by dividing the percentage of area in the sanctuary protected by the percentage of income impact.

Chapter 3 – Step 2 Analysis

Chapter 2 provided our Step 1 analysis of alternatives. Many tables, which contained many numbers, were presented. Here our approach is more comprehensive, but also much less quantitative since all the benefits and costs of marine reserves cannot be quantified. Even though we are not able to exactly quantify the benefits to nonconsumptive users or the nonuse/passive use value of marine reserves, we do try and provide a range of possible values using some conservative ranges of estimates and some assumptions. The problem with arriving at a net assessment, as in a formal benefit-cost analysis, is that we don't always have a common metric across different uses or user groups. What we do try and do here is address the question of 1) how likely is it that the Step 1 Analysis results are real? (Under what conditions and time frames might they be underestimates or overestimates of impact of costs or might short-term costs turn into long-term benefits) and 2) Once we look at the benefits side of the ledger, even with rough quantification, Can we say anything about net benefits or costs?

As mentioned in the introduction to this report, there is a lot of uncertainty about forecasting the future biophysical responses and socioeconomic behavioral responses that will determine outcomes. The Science Panel has not provided quantitative forecasts of biophysical conditions, for which we could then quantify the socioeconomic dimensions. There is simply a limitation in data and models and as the Science Panel has recognized, it would be an overwhelming task to address species-by-species the biophysical responses to protection strategies. But as we also mentioned in the introduction, adaptive management is the institutional response to uncertainty and what we provide here is information and what is known from our theoretical literature on what are the important factors to understand. We hope all this will better inform the adaptive management process.

Before launching into our analyses, we first discuss the many issues, mitigating and offsetting factors and some theoretical literature that may provide some guidance in interpreting or understanding how the many factors interact and the qualitative direction of outcomes under various conditions.

Current Status of Exploited Fishing Stocks. One of the basis assumptions of our Step 1 analysis for the consumptive activities is that our baseline estimates of impact can be used as an approximation of the average impact in the future. This assumes that the current levels of exploitation are sustainable in the future. The Science Panel did not rely on single species stock assessments to develop their design criteria. Formal stock assessments have been done on a few species or are underway (e.g., sardine, squid, cowcod, blackgill rockfish and bocaccio). Some data are available for sea cucumber. No data (or limited data) is available for red sea urchin, spiny lobster, prawn, abalone, crab, and California sheephead.

In developing our baseline estimates we looked at the trends in catch of the 14 species/species groups in our commercial fishing analysis (Appendix C). Table 3.1 summarizes the trends found in Appendix C, along with the trends and status of some species/species groups as summarized by the Science Panel. As noted above, few stock assessments have been completed. The only widely recognized species/species groups that are considered to be in overfished status are rockfish and abalone. Rockfish made up 2.45% of our estimate of baseline 1996-1999 ex vessel value and abalone was not in our baseline since harvest was halted in 1997. Eight of the 14 species/species groups in our baseline for the commercial fisheries show no trends in catch, four have upward trends and two downward trends (rockfish and kelp) in the CINMS. Statewide, nine had no trends, four had downward trends and one (wetfish) had a slight upward trend. Kelp, and the interaction of many species and kelp, has been noted and kelp and seaweed have been heavily impacted by warmwater El Nino events. Kelp is assigned a general downward trend, but with expectations of recovery as warmwater events subside. We have not been able to find any information saying there is an overharvesting of kelp. Given the current state of knowledge about the status of the exploited stocks, and the fact that trends within the CINMS and Statewide are mixed (but on balance more upward in the CINMS and more downward Statewide), we believe the current status of stocks provide no information to suggest whether our overall baseline estimates are overestimates or underestimates of impact.

Table 3.1. Commercial Fishing and Kelp: Trends and Status of Stocks

Factors	Trends in CINMS	Trends in CA	Trends/Status Science Panel Status Report
Squid	None	None	None/Assessment Underway, Not Clear
Wetfish	Upward	Upward	- /Not Assessed
Rockfish	Downward	Downward	Downward/ Overfished[1]
Urchins	None	Downward	Downward/Unclear
Crab	None	None	None/Not Assessed
Spiny Lobsters	None	None	None/Stable
Flatfish	Upward	Downward	-
Sea Cucumber	Upward	None	Downward/Underway
Sculpin and Bass	None	None	-
Tuna	None	None	-
Shark	None	None	-
CA Sheepshead	None	-	-
Prawn	Upward	-	Ridgeback downward spot Prawn not Well Studied
Kelp	Downward	Downward	Downward, highly influenced by ElNino events, recovering

1. See Science Panel Report.

Replenishment Effect/Stock Effects. This refers to the notion that stocks of currently exploited species will increase in biomass if the stocks are protected by marine reserves. The issues can be complex, but for our purposes it only matters if there is a net increase in biomass and aggregate harvest in the remaining open areas due to the marine reserve protection. Some species of rockfish have long and slow growing life cycles and therefore replenishment effects will take place over much longer time frames. Replenishment effects will generally take place over longer periods of time and this factor should yield increasing mitigation of costs over time, and under certain conditions, could be expected to yield net benefits sometime in the future. For consumptive users, there may be mitigation of costs even in the short-term. Many consumptive users have been observed lining up along the edges of marine reserves in the Florida Keys National Marine Sanctuary (FKNMS Research and Monitoring Report, 2001). In a recent issue of *Science*, Roberts et al (2001) show the edge effects of the Merritt Island National Wildlife Refuge at Cape Canaveral, Florida on recreational fishing records maintained by the International Game and Fish Association (IGFA). There were more recreational fishing records set on the edge of this reserve than in all of the rest of Florida and the number of records is increasing faster on the edge of the reserve than in all the rest of Florida. Also, net increase in biomass and aggregate harvests were two criteria Sanchirico and Wilen (2001) addressed for commercial fisheries, which will be discussed in more detail below.

Substitution/Relocation. For commercial fishing and kelp harvesting, a mitigating or offsetting factor would be the ability to relocate effort to others areas and be just as successful (no loss) or be able to at least mitigate losses to some degree. For the recreation consumptive users (recreational fishing and consumptive diving), the issue is similar, except the recreation consumptive users are the final consumer's of the services from the natural environment. Can this group of users find perfect substitutes by relocating to other sites (no loss) or will they find less than perfect substitutes involving either increased costs (travel to more distant sites) or reduced quality (catch per unit of effort, different species mix, rougher or less protected waters). This will be discussed further in the section on Recreation Consumptive use.

For consumptive users displaced from current sites, a fundamental issue is the current status of the stocks of species, for which they pursue in the areas outside the protected areas. Also, as discussed in the benefits and costs section of the introduction to this report, the impact will be contingent on how the areas outside the marine reserves respond ecologically/biologically. And following Sanchirico and Wilen (2001) one can see that the net effects depend on both the ecological/biological responses and the human responses. Generally, the larger the area included in marine reserves, the lower the probability that substitution and relocation will be successful in mitigating or offsetting Step 1 impacts.

Crowding/Congestion Effects. Displacement of consumptive users means we have to address what happens to this displaced effort. The net result of crowding or congestion effects is to increase estimates of negative impact beyond those estimated in Step 1. This is the most important exception to our references to baseline estimates as representing maximum potential losses.

The Science Panel concluded that the effort displaced from the marine reserves must not be allowed to relocate to the remaining open areas or the catch in the remaining open areas must remain constant. Under this scenario, estimates in our Step 1 analyses would remain our best estimates. In the Nearshore Fishery Management Plan, there is also recognition that the fisheries management plan will have to be integrated with the Marine Life Protection Act (MLPA) closed areas and this will mean holding catch and/or effort in the remaining open areas at current levels when implementing closed areas. This is to avoid the damaging effect of relocating effort and resulting reduced catches in the remaining open areas. Again, our Step 1 analysis estimates would be applicable in this situation. But if catch is not held constant in the remaining open areas or effort not reduced to match the displace effort from the closed areas, and the stocks are at MSY or below, then the released effort would simply be crowded into a smaller remaining space and will drive the fisheries in the remaining open areas to sub-optimal conditions, perhaps resulting in the collapse of these fisheries. If crowding and congestion lead to reductions in harvest from the remaining open areas, then our Step 1 estimates are under estimates. It is important to note that there is not one study of marine reserves that demonstrates that crowding or congestion effects have occurred. It does, however, remain a theoretical possibility.

Quality Increases in Marine Reserves. The Science Panel's review of the literature points to the tremendous amount of research showing the increases in many dimensions of the quality of sites that have been protected by no take regulations. Often the changes that occur on the sites protected are noticeable in a year or less (Florida Keys National Marine Sanctuary Monitoring Report, 1999). Increases in the numbers and average size of animals are a common finding. Changes in biodiversity, community structure, and general habitat conditions have been known to take place even in the short-term and would be expected to improve further over time. For nonconsumptive users, nonusers or those with passive use values there would be growing benefits over time. There are also the scientific and education benefits of studying and observing changes and having control sites, which help in interpreting the relative causes of the changes observed.

Other Regulations. Other regulations can work towards mitigating, offsetting, avoiding costs, or in increasing the costs. Some regulations are known to have short-term costs with long-term benefits to the fishermen. But because many fisheries are open access, fishermen that suffer the short-term costs (make an investment) are not guaranteed that they will receive the benefits (the return on investment).

Most regulations are a response to a problem, which if not addressed, would presumably get worse. The status quo would result in increasing losses. So the assumption that any changes in current activities are always losses doesn't take into account that the future path may be lower levels of current activity without the regulatory intervention. In this case, our baseline estimates of loss are over estimates because the levels of activity are not sustainable. We addressed this issue above in the status of the stocks.

Many fishery regulations are what economists describe as regulated inefficiency. Sometimes inefficiencies are imposed to more equitably spread out the benefits of a fishery by forcing all involved to adopt more economically inefficient methods of harvest. But in the commercial fisheries, fish is mostly a food product that competes with many food products. Over the long run, pressure builds and market forces work to the detriment of those that produce inefficiently. These are forces beyond the control of fishermen or fishery managers. Most economists recommend against using inefficiency, except as a temporary transition strategy. Regulations that make the fisheries inefficient will lead towards a status quo (without marine reserves) downward path in the regulated activity. This would mean that our baseline estimates in Step 1 are overestimates of potential costs. The weekend closure of the squid fishery is a good example of regulated inefficiency and will be discussed further below.

Regulations may be designed to benefit one group at the expense of another group. Allocation between user groups of total allowable catch is an example. California Proposition 132 restricted the use of gill nets within one mile from shore. This has reduced catch to gill net fishermen and some are claiming that this has been a benefit to recreational fishermen (Kronman, 2001). As we showed in Chapter 1, the top 20 recreationally caught species changed significantly in both numbers caught and species mix in years 1999 and 2000. And, number of fishing trips ended their long decline (1993 – 1999) and increased, in 2000, almost to their 1996 level. One year of data isn't enough to forecast a new trend, however, it does raise the possibility that our baseline recreational fishing estimates are under estimates of the impacts in the future.

Some measures are taken only when the fisheries have collapsed or are at near collapse. The cowcod closures and the Nearshore Fishery Management Plan for rockfish are good examples. The efforts here are on rebuilding stocks. Many have joked that the development of a fishery management plan is the beginning of the end of a fishery. An obvious overstatement, but there have been many more failures than successes in fishery management in the marine environment. In the MRWG process, some viewed the cowcod closure as a substitute for marine reserves in the CINMS. We think the cowcod closure falls into that category of a regulation that requires investment to get a future return. But with many rockfish (because of their noted slow growth rates and longer life cycles) this may require a long-term investment to get an even longer-term return on investment. Given the open access nature of the fishery, we would predict that fishermen would heavily discount future benefits, since they don't expect to see the returns. They would not want to make further investments in more closed areas. The impacts that we have estimated in Step 1 are in addition to the impacts already felt from the cowcod closure. There is no additional impact beyond what we have estimated. We don't see the cowcod closure as a factor making the impact of the marine reserves greater than we have estimated in Step 1. If the cowcod closure works, it should be a long-term mitigating and offsetting factor making our estimates of impact overestimates in the long-term. The stripped bass closures on the East Coast of the U.S. were a great success after five years. Both the commercial and recreational fisheries have benefited greatly. The CDFG has proposed to open some of the currently closed areas to compensate for the closed areas in the CINMS. Some of the areas were just the nearshore areas closed to invertebrates, so the offsets will be limited to those consumptive user groups pursuing invertebrates. Opening up the cowcod closure areas will offset the losses to those pursuing species restricted by the cowcod closure. So even in the short-term our Step 1 analyses will overstate the costs when the cowcod closure and the Nearshore Fishery Management Plan is considered.

MLPA Process. The Marine Life Protection Act (MLPA) is a California law directing the establishment of a network of marine protected areas (including no take areas) throughout the State. The CINMS areas in State waters are the first to be considered in this process. Other efforts that were simultaneously underway have been delayed. Establishment of these areas would additionally impact consumptive users. In establishing additional areas outside the CINMS, it will be important to recognize the cumulative impact that these areas will have. However, there is not a specific set of proposed areas right now, so there is no way we can add impact now. We can only recognize that these areas may present additional impact in the future. If data and analyses are done, as was done here for the CINMS sites, one should be able to estimate the impacts of future closed areas. The MLPA process may also be used to implement the concept of phasing marine reserves. This will be discussed further under the phasing section .

MLMA Process. The Marine Life Management Act (MLMA) is a California law directing the establishment of fishery management plans. Above we mentioned the Nearshore Fishery Management Plan. Another plan currently under development that will be highly relevant in the squid plan. The squid plan is not final, but some of the options include a limited entry program and a reduction in current capacity. As mentioned above with respect to the crowding issue and the Science Panel's recommendation of catch and/or effort reductions in the remaining open areas, matching displaced catch and effort from the marine reserves would be a requirement that would need to be incorporated in all the management plans if stocks are at or below MSY or else the crowding effects could make losses greater than our Step 1 analyses. However, there are conditions for which the crowding effects won't occur. Until other fisheries management plans are finalized, we can't assess their impacts.

There have been limited discussions of the use of individual transferable quotas (ITQs) in developing fishery management plans. ITQs are preferred by a large majority of economists because they can be

designed to take advantage of market efficiencies. ITQs address the fundamental problems of open access, common property resources. They allow users to benefit from investments in the fisheries. Issues of equity and efficiency can be addressed in initial assignments of quotas. ITQs would no doubt result in much greater initial reductions in capacity, income and employment in the commercial fisheries. But over the long-term this approach would most likely yield sustainable commercial fisheries that would have the best chance of competing with other food products. This kind of rationalization of the fisheries would lead to very high offsets in losses estimated in our baseline Step 1 analysis. However, so far there appears to be no serious efforts in this direction.

How ITQs would affect the recreational fishing community is unknown without addressing the details of one of the key first steps, allocation of a given allowable catch between the commercial and recreational fisheries. The usual approach is historical proportions. There is usually a dearth of data and analysis to support an economic approach i.e., one that maximizes the value of the use of the resources.

One approach to ITQs that has been overlooked by most attempting to implement ITQs is the possible double payoff of letting nonusers buy ITQs and then not harvesting their allotment. This allows the stocks to grow to a larger size. User group allocations and ITQs are stated in terms of a share of the allowable catch. Allowable catch grows over time and each user group is a beneficiary. Nonusers get to put their money where their mouth is, so to speak, and everyone benefits.

If ITQs were implemented in the commercial fisheries, our estimates of impact from marine reserves would be over estimates since implementation of the ITQs would result in much lower capacity in the fisheries[5]. For the recreational fisheries, the impacts would be dependent on the allocations of allowable take. If nonusers were allowed to purchase ITQs and not harvest their share, our estimates for all consumptive user groups would be over estimates.

Existing Area and Temporal Closures. Above we addressed the cowcod closure and to some extent the closure of nearshore areas to gill nets and to taking of invertebrates. The U.S. Department of Interior's Fish and Wildlife Service and Channel Islands National Park has seasonal area closures to protect nesting birds. These regulations may have some additional impacts from what we have estimated. Those regulations that were already in effect in areas that will now be marine reserves will mean no additional impact than we already estimated in Step 1 i.e., they were already accounted for in our Step 1 analysis. For those areas outside the marine reserves, the impacts would be in addition just as in other area closures discussed above.

Pendleton, Cai and Lutz (2001) analyzed temporal closures (weekend closures) in the Southern California squid fishery. They found that temporal closures resulted in fishermen taking more risks by fishing in bad weather conditions. This raises the cost of harvest (accidents go up with possible injury to crew and loss of life and/or property and insurance rates go up) as crew and equipment are put at greater risk. This is an unintended cost of the effort-reduction regulation. Pendleton, Cai and Lutz (2001) cite an abundance of the economic literature documenting and commenting on the unintended economic costs of effort-limiting regulations.

The interaction of temporal closures and geographic closures could have a compounding effect which would make our estimates of impact under estimates as the squid fishermen take more risks by fishing in bad weather conditions, while crowded into smaller remaining open areas.

Economic Conditions and Other Outside Forces and Internal Forces. Many fishermen, especially commercial fishermen, have expressed concerns about the many outside forces and internal forces that they believe are affecting their ability to maintain sustainable fisheries. Many issues were gleaned from the ethnographic data survey conducted for the CINMS. See Kronman et al (2001). We summarize the issues below.

Outside Forces

- Poor Asian economy
- Strong dollar

- International competition
- Increased cost-of-living in coastal areas
- El Nino events
- Pollution and habitat destruction from coastal development
- Conflicts over environmental allocations (sea otters, seals and sea lions, birds)
- Conflicts among user groups

Internal forces

- Aging workforce
- Industrial organization (buyers and processors with monopoly power over fishermen)
- Open access and overcapitalization and biological and/or economic overfishing

Outside Forces. Before the recessions in the Asian economies, California fisheries were benefiting from Asian demands for Live Fish and Spiny Lobster, for which fishermen were receiving significantly higher prices. The Chinese demand for squid raised prices to fishermen. Urchins primary market is Japan. The combination of the recent strong dollar and economic slow down in Asia has put strong downward pressures on demand and prices for some of the most valuable fisheries in California. As we showed in Chapter 2, CINMS catch of squid and urchins were only a small percent of world supply and fishermen face strong international competition. The strong dollar puts California fishermen at a competitive disadvantage.

Coastal development increases the general cost-of-living. Commercial fishermen must compete for limited dock space at local ports and harbors with costs of berthing their boats on the rise. Many feel that coastal development is also destroying important habitat and increases pollution that effects the fish stocks on which their livelihoods depend.

Fishermen find themselves in conflict with environmental groups that represent the interests of Americans that value the protection of various wildlife species (e.g., sea otters, seals and sea lions and birds) that compete for the seafood they are harvesting.

There are also conflicts between commercial fishermen and recreational fishermen over allocations of limited stocks of fish.

El Nino events have had enormous impacts on the fisheries.

InternalForces. Even though most of the factors we label as internal are factors not under the control of fishermen, they are more directly involved with these factors from an industry perspective, so we label them as internal. They are additional factors, for which fishermen perceive they cannot control and thus raise uncertainty about the future. Some fishermen in the MRWG process mentioned the aging workforce in their industry and were concerned about the loss of a way of life and community. Some fishermen have complained of the buyer/processors and their monopoly power. This allows buyers/processors to hold prices to fishermen artificially low and capture more of the benefits for themselves. And as we have already discussed above, some fishermen recognize the problem with open access common property and the incentives leading to overcapitalization and overfishing (both biological and economic).

Fishermen seem to view all of these factors coming together as an overwhelming set of forces. Marine Reserves are regarded as simply “the straw that broke the camels back”. Whether these perceptions are accurate is not that important for understanding one dimension of social costs. People’s behavior is often driven by perceptions. Education and outreach efforts can be utilized to educate people about the facts and lessen some of the costs of actions taken based on incorrect information. However, there can be significant social transaction costs of people challenging regulations, which they perceive as having undue impact. Molotch and Freudenburg (1996) and Paulsen, Molotch and Freudenburg (1996) conducted two studies on Santa Barbara and Ventura Counties for the U.S. Department of Interior’s Minerals Management Service. Their reports provided profiles of the county populations and discussed the

socioeconomics and political economic aspects of how the communities might respond to issues of oil and gas development. An important aspect of these studies was the identification of "social multipliers". The authors argued that the economic multipliers could not explain the relative power of oil and gas interests in the area. Instead, one had to understand the social multipliers (how groups work together in coalitions) to understand the public policy outcomes and the costs in arriving at those outcomes.

The point of this discussion is that no matter how accurate or how large or small our estimates of impact, the perceptions of impact from cumulative sources may result in social multipliers that stimulate actions which have large transactions costs. 85% of squid fishermen oppose closed areas (Pomeroy and Fitzsimmons 2001) and 95% of the Barilotti sample opposed closed areas. These social costs are not included in our Step 1 analysis.

Phasing of Marine Reserves. The phasing in of marine reserves is similar to the issue of substitution in that the more time people have to learn and adjust to changes, the greater their ability to mitigate or offset the costs. This was an issue discussed by the MRWG, but never implemented in any formal alternatives. It is not included in any of the alternatives that we were asked to analyze here. In "The Proactive Fishermen's Plan" (Miller and Liquornik, 2001), the idea of phasing is recommended to lower the costs to the fishermen. The MLPA process has been delayed. There is an opportunity to use the concept of phasing by delaying any additional closed areas in state waters currently fished by CINMS fishermen. This strategy would lower additional costs imposed by closed areas beyond those being considered in the CINMS.

Pelagic or Highly Migratory Species. Some species such as swordfish, tuna and possibly wetfish may not be impacted by closed areas, since fishermen are likely able to capture them when they move through the adjacent open areas. This has proven to be the case in the Florida Keys National Marine Sanctuary. Even though squid and shark are pelagic species, from what we have read, we are less certain whether the same conclusion applies. We would expect no impacts to swordfish, tuna and wetfish and therefore our estimates for Step 1 are over estimates. This varies by alternative from a 1.32% reduction in impact for alternative 4 to a 3.1% reduction for the preferred alternative.

Commercial Fisheries and Kelp – Step 2 Analysis

Sanchirico and Wilen (2001) provide a theoretical bioeconomic model that incorporates new ecological developments with respect to patchy environments. The authors use the model to address the issue of marine reserves. These authors addressed closed systems, sink-source systems and density dependent systems. They generally assume a Smith (1968) rent dissipation type bioeconomic model and assume spatial arbitrage i.e., fishermen relocate and equilibrium is reached when economic rents are equalized across space. They do not address outcomes in terms of net economic benefits (consumer's surplus plus economic rents). Instead, they limit their conclusions as to what would happen to aggregate biomass and aggregate harvest under varying conditions. We limit the discussion here to their discussion of sink-source systems and density dependent systems because the CINMS and surrounding areas are more likely to be some combination of sink-source and density dependent systems.

Sanchirico and Wilen (2001) provide the following propositions (renumbered here because we don't include their discussion of closed systems):

A. Sink – Source Systems

Proposition 1. "In a sink-source system with unidirectional density dependent flow, closing the sink will increase aggregate biomass and decrease aggregate harvest. A loss in harvest from the sink without any gain from harvest to the source", thus a net loss to the commercial and recreational fisheries.

Proposition 2. "In a sink-source system with unidirectional density dependent flow, closing the source will unequivocally increase aggregate biomass. Aggregate harvest will also increase if the increase from dispersal due to large biomass is greater than the loss in pre-reserve harvest from the closed area."

This double-payoff in increased biomass and harvest is more likely under the following conditions:

1. Source patch cost/price ratios are very low
2. Dispersal rates cannot be too low or too high
3. Growth rate of the stock in the source is greater than the dispersal rate

B. Density Dependent Systems

"Reserve creation in a density dependent system will always increase aggregate biomass".

Proposition 3. "In a density-dependent system, creating a reserve by closing a patch will increase aggregate biomass". Aggregate harvest will also increase if:

1. Patch closed is at a low level before closing (low opportunity costs – not much harvest lost)
2. If cost/price ratios between open and closed areas are not too dissimilar (close)

The Sanchirico and Wilen (2001) model then predicts that there are conditions under which there can be benefits of marine reserves to the commercial fisheries, but these benefits are conditioned on both ecological/biological and human behavioral conditions and responses.

Commercial Fishing and Kelp, Analysis of Alternatives – Step2

Above we discussed the various factors that could mitigate or offset costs or that would result in benefits to commercial fishermen. Impacts were judged relative to our estimates from Step 1 analyses, as presented in Chapter 2. So a neutral score means no change to our Step 1 estimates of impact. A score of increased costs means we would expect the factor to increase our estimates of impact beyond what was estimated in Step 1 or our impacts in Step 1 were under estimates. A score of decreased costs mean this factor would be

expected to decrease the expected impact from what we estimated in our Step 1 analyses or that we over estimated the impacts in Step 1. Finally, a score indicating benefits means this factor would contribute to net benefits (no losses) and thus the impacts estimated in Step 1 are not real or would not be expected to occur. There is a time dimension to the evaluation. We limit this to a short-term (1 to 5 years) and a long-term (5 to 20 years). The results are summarized in Table 3.2.

Table 3.2. Commercial Fishing & Kelp: Impacts Relative to Step 1 Analysis

Factors	Short-term	Long-term
1. Status of Fishing Stocks	O to ● (rockfish)	O to ● (rockfish)
2. Replenishment Effects	□	■
3. Substitution/Relcoation	□	□
4. Crowding/Congestion Effects	●	●
5. Quality Increases in Marine Reserves	O	O
6. Other Regulations		
a) Regulated Inefficiency	□	□
b) Proposition 132 (Gillnet Restriction)	O	O
c) Allocations to Other User Groups	●	●
d) Cowcod Closure	●	■
e) Opening up some Cowcod Closure Areas	□	□
f) MLPA - Closed Areas	O	O
g) MLMA Fishery Management Plans	O	O
h) ITQs currently not being considered	O to □	O to □
I) Existing Area Closures	O	O
j) Temporal Closures	●	●
k) Economic Conditions and Outside and Internal Forces	●	●
7. Pelagic Species	□	□
8. Phasing	□	□
All Factors	O to ●	□ to ■

O = Neutral Impact
● = Increase in costs from Step 1
□ = Decrease in costs from Step 1
■ = No costs from Step 1 - instead, benefits

For the short-term, our net assessment for commercial fishing and kelp ranges between a neutral impact to an increase in costs beyond Step 1. The most important factors influencing this assessment are the current status of stocks (neutral except for rockfish), regulated inefficiency (decrease costs) and the Science Panel's recommendation that catch and/or effort be held constant in the remaining open areas is not implemented (increases cost). The Science Panel's recommendation requires that the effort displaced must exit the fisheries i.e., the assumption of our Step 1 analysis. There is uncertainty about whether such catch and effort recommendations will be included in current and future fishery management plans. If not, the problem of crowding and congestion would probably result in increased costs (beyond Step 1 costs) in the short-term. In addition, the social costs of not excepting regulations, which might result in increased enforcement costs, which could increase costs beyond those estimated in Step 1.

For the long-term, assuming replenishment effects (benefits), substitution/relocation (decrease costs), cowcod closure (benefits) and regulated inefficiency (decrease costs) lead to a conclusion that impacts in Step 1 were over estimated and there are possibilities of net benefits, per the discussion of the Sanchirico and Wilen (2001) analysis. Over the long-term, people have a chance to learn and adjust to changes and there is more time for the biophysical responses to protection to come to fruition. Management plans can be adjusted to respond to any negative outcomes (adaptive management).

The issues of phasing, ITQs, MLPA closed areas and MLMA fishery management plans are actions, which are not fully specified at this time or are not seriously being considered (ITQs). We are forced to simply give them a neutral score at this time.

Below we give our net assessments by alternative for commercial fishing and kelp, since size of an alternative matters for many of the mitigating and offsetting factors.

Alternative 1. This is the smallest among the marine reserves in both size and impact on commercial fishing and kelp. There will be a high probability of relocating effort and a low probability of crowding and congestion effects both of which should decrease costs relative to our Step 1 analysis. The ability to catch tuna and wetfish in surrounding areas lowers Step 1 estimates by about 1.35%. The relatively low impact to squid (5.46%) means the possible additional costs of the interaction with weekend closures will result in no additional costs beyond Step 1. There is some possibility that this low level of catch reduction in squid could be made-up from catch in other areas, to the extent that squid move around and they can be caught in the remaining open areas. The kelp impacts are also relatively low for this alternative (4.43%), however it is not clear that this can be made up by additional harvest in other areas. This alternative has a relatively high estimated impact on prawn fishermen (24.78%). It is not clear whether this cost could in anyway be mitigated. In the short-term, the overall impacts estimated in Step 1 are most likely over estimates. If the squid catch losses could be replaced from other areas, the reduction in impacts would be as much as $742,133 (34% of step 1 estimated loss of $2,161,955), since squid accounts for about 33 percent of the step 1 impact, while pelagics (tuna and wetfish) account for 1.35%. These reductions in impact would bring the average annual impact down to $1.4 million in ex vessel revenue or 5% of the 1996-1999 baseline.

In the long-term, the replenishment effects are likely to be minimal since the marine reserves only cover about 12 percent of the CINMS, with only two of the 15 habitat types in the Science Panel report receiving protection levels of 20 percent or higher. The benefits to areas outside the marine reserves are probably minimal for this alternative and the long-term mitigation of costs lower. Whether replenishment effects are greater than crowding or congestion effects will determine if this alternative's long-term cost can be transformed into long-term benefits.

Alternative 2. This is the second smallest among the marine reserves in both size and impact on commercial fishing and kelp. There will be a high probability of relocating effort and a low probability of crowding and congestion effects both of which should decrease costs relative to our Step 1 analysis. The ability to catch tuna and wetfish in surrounding areas lowers Step 1 analysis costs by 1.58 %. Like alternative 1, this alternative has a relatively low impact on the squid fishery (5.56%). Kelp impacts are also relatively low for this alternative (5.55%), but just as with alternative 1, we are not certain kelp harvest can be increased from other areas. This alternative has a relatively high impact on prawn fishermen (19.41%) and it is not clear how or if this impact could be mitigated. As in alternative 1, it might be possible that squid catch could be replaced from other areas. Since squid represents about one-third of the lost ex vessel value of catch from alternative 2, it is possible that our Step 1 analysis estimates could be reduced by over 34 percent, even in the short-term. These reductions in impact would bring the average annual impact down to about $1.46 million in ex vessel revenue or 5.17% of the 1996-1999 baseline

In the long-term, the replenishment effects are likely to be minimal since the reserves only cover about 14 percent of the CINMS, with only four of the 15 habitat types in the Science Panel report receiving protection levels of 20 percent or higher. The benefits to areas outside the marine reserves are probably minimal for this alternative and the long-term mitigation of costs lower. Whether replenishment effects are greater than crowding or congestion effects will determine if this alternative's long-term costs can be transformed into long-term benefits.

Alternative 3. This is the third smallest among the marine reserves in both size and impact on commercial fishing and kelp, however, this alternative covers 21 percent of the CINMS. There will be a high probability of relocating effort and a low probability of crowding and congestion effects both of which should decrease costs relative to our Step 1 analysis, but less so than alternatives 1 and 2. The ability to catch tuna and wetfish in surrounding areas lowers Step 1 analysis costs by 1.58 %. Like alternatives 1 and

2, this alternative has a relatively low impact on the squid fishery (5.66%). Kelp impacts are also relatively low for this alternative (4.98%), but just as with alternatives 1 and 2, we are not certain kelp harvest can be increased from other areas. This alternative has a relatively high impact on prawn fishermen (29.45%) and it is not clear how or if this impact could be mitigated. As in alternative 1 and 2, it might be possible that squid catch could be replaced from other areas. Since squid represents about 31 percent of the lost ex vessel value of catch from alternative 3, it is possible that our Step 1 analysis estimates could be reduced by about 33 percent, even in the short-term. These reductions in impact would bring the average annual impact down to about $1.59 million in ex vessel revenue or 5.63% of the 1996-1999 baseline

In the long-term, the replenishment effects are of medium likelihood since the reserves cover about 21 percent of the CINMS, with six of the 15 habitat types in the Science Panel report receiving protection levels of 20 percent or higher. The benefits to areas outside the marine reserves are higher than alternatives 1 and 2, and the long-term mitigation of costs greater than for alternatives 1 and 2. Whether replenishment effects are greater than crowding or congestion effects will determine if this alternative's long-term costs can be transformed into long-term benefits.

Alternative 4. This is the second largest among the marine reserves in both size and impact on commercial fishing and kelp. This alternative covers 29 percent of the CINMS. There will be a medium probability of relocating effort and a low probability of crowding and congestion effects both of which should decrease costs relative to our Step 1 analysis, but less so than alternatives 1, 2,3 and the preferred alternative. The ability to catch tuna and wetfish in surrounding areas lowers Step 1 analysis costs by 1.32 %. This alternative has a more significant impact on the squid fishery (13.58%). Kelp impacts are still relatively low for this alternative (7.81%). We are not certain if squid harvest could be increased enough to fully offset the losses from this alternative. If half of the estimated losses could be replaced, then 21.37% of the total impact on ex vessel value of this alternative would be mitigated. As with other alternatives, we are not certain if kelp harvest can be increased from other areas. This alternative has the highest impact on prawn fishermen (41.11%) and it is not clear how or if this impact could be mitigated. If half the squid losses could be replaced from other areas, it is possible that our Step 1 analysis estimates could be reduced by about 23 percent, even in the short-term. These reductions in impact would bring the average annual impact down to about $3.2 million in ex vessel revenue or 11.35% of the 1996-1999 baseline.

In the long-term, the replenishment effects are of high likelihood since the reserves cover about 29 percent of the CINMS, with 14 of the 15 habitat types in the Science Panel report receiving protection levels of 20 percent or higher. Seven habitat types receive more than 30 percent protection. The benefits to areas outside the marine reserves are higher than alternatives 1,2,3 and the preferred alternative, and the long-term mitigation of costs greater than for alternatives 1, 2, 3 and the preferred alternative. Whether replenishment effects are greater than crowding or congestion effects will determine if this alternative's long-term costs can be transformed into long-term benefits.

Alternative 5. This is the largest among the marine reserves in both size and impact on commercial fishing and kelp. This alternative covers 34 percent of the CINMS. There will be a low probability of relocating effort and a high probability of crowding and congestion effects, the net effect is more likely to be an increase in costs relative to our Step 1 analysis. The ability to catch tuna and wetfish in surrounding areas lowers Step 1 analysis costs by 2.04 %. This alternative has the highest impact on the squid fishery (16.52%) and on kelp harvesting (12.2%). As with other alternatives, we are uncertain if kelp harvests could be increased from other areas. As with alternative 4, we are not certain if squid harvest could be increased in outside areas enough to fully offset the losses from this alternative. If half of the estimated losses could be replaced, then 21% of the total impact on ex vessel value of this alternative would be mitigated. This alternative has relatively high impact on prawn fishermen (29.26%) and it is not clear how or if this impact could be mitigated. If half the squid losses could be replaced from other areas, it is possible that our Step 1 analysis estimates could be reduced by about 24 percent, even in the short-term.

In the long-term, the replenishment effects are of high likelihood since the reserves cover about 34 percent of the CINMS, with all 15 habitat types in the Science Panel report receiving protection levels of 24 percent

or higher. Ten habitat types receive 30 percent or more of protection. The benefits to areas outside the marine reserves are higher than all other alternatives, and the long-term mitigation of costs greater than for all other alternatives. Whether replenishment effects are greater than crowding or congestion effects will determine if this alternative's long-term costs can be transformed into long-term benefits.

Preferred Alternative. This alternative is mid-ranged among the marine reserves in both size and impact on commercial fishing and kelp. This alternative covers 25 percent of the CINMS. There will be a medium probability of relocating effort and a low probability of crowding and congestion effects, the net effect is more likely to be decrease in costs relative to our Step 1 analysis. The ability to catch tuna and wetfish in surrounding areas lowers Step 1 analysis costs by 2.09 %. This alternative has medium impact on the squid fishery (13.12%) and a relatively low impact on kelp harvesting (5.55%). As with other alternatives, we are uncertain if kelp harvests could be increased from other areas. As with alternatives 4 and 5, we are not certain if squid harvest could be increased in outside areas enough to fully offset the losses from this alternative. If half of the estimated losses could be replaced, then 24.3% of the estimated step 1 total impact on ex vessel value of this alternative would be mitigated. This alternative has the lowest impact among all alternatives on prawn fishermen (16.7%), but it is not clear how or if this impact could be mitigated. If half the squid losses could be replaced from other areas, it is possible that our Step 1 analysis estimates could be reduced by about 27 percent, even in the short-term. These reduction in impact would bring the average annual impact down to about $2.6 million in ex vessel revenue or 9.08% of the 1996-1999 baseline.

In the long-term, the replenishment effects are of high likelihood since the reserves cover about 25 percent of the CINMS, with all 15 habitat types in the Science Panel report receiving protection levels of 21 percent or higher. Eight habitat types receive 30 percent or more of protection. The benefits to areas outside the marine reserves are lower than the benefits from alternatives 4 and 5, but higher than those from alternatives 1, 2 and 3. The long-term mitigation of costs would be expected to be lower than those for alternatives 4 and 5, but greater than those for alternatives 1, 2 and 3. Whether replenishment effects are greater than crowding or congestion effects will determine if this alternative's long-term costs can be transformed into long-term benefits.

In our review of the literature and discussions with the Small Business Administration, we could find no standard of comparison, in terms of percent of revenue or income loss, for which we could provide guidance as to the future success or failure of commercial fishing businesses. The rates of small business failures are extremely high and no reliable relationships have been established between revenue or income losses due to regulations and business failures. So we cannot provide guidance on how to translate the potential impacts into the magnitude of possible business failures.

The commercial fishermen participating in the MRWG process had their own standard for judging the impact of the marine reserves. The fishermen adapted a 10% standard. In the many alternative marine reserve designs that we analyzed for the fishermen, the fishermen were using the 10% or less impact on ex vessel revenue as their standard. We are not exactly sure what the standard means except that it seems to mean the amount of impact that they could live with. We might interpret this to mean the amount of impact that they could adjust to and still maintain a viable fishing business.

If we use the commercial fishermens' 10% standard and the step 1 estimates of potential loss in ex vessel revenue, Alternatives 1, 2, and 3 had estimated impacts less than 10% (7.69%, 7.90% and 8.43%, respectively). The Preferred Alternative and Alternatives 4 and 5 have potential impacts of 12.53%, 14.74% and 18.28%, respectively. If we use the commercial fishermens' 10% standard and our adjusted step 1 estmaites of potential loss in ex vessel revenue (assuming no impacts on wetfish, tuna and partial impacts on squid), Alternatives 1,2,3 and the Preferred Alternative have impacts less than 10% (5.02%, 5.17%, 5.63, and 9.08%, respectively). Alternatives 4 and 5 would still exceed the commercial fishermens' standard (11.35% and 14.00% respectively).

Recreation: Consumptive Activities – Step 2 Analysis

In the above analysis losses were discussed as maximum potential losses. The assumption was made that those losses were real and there was no way to recover from being displaced from the respective marine reserve alternatives. In this section we investigate the effect of possible mitigating factors on these losses to consumptive users and benefits to non-consumptive users and non-users. Although these issues are addressed quantitatively where possible, the discussion is largely qualitative because it is generally not possible for us to quantify mitigating factors and benefits. Even though we discussed substitution and the long-term benefits from replenishment effects in the introduction, for this chapter, we revisit these two important mitigating factors with a more pointed discussion about how they relate to recreation.

Substitution. If displaced users are simply able to relocate their activities, they may be able to fully or partially mitigate their losses. This of course depends on the availability of substitute sites and the qualities thereof. Several scenarios are possible. Even when total activity remains constant (i.e., person-days remain the same as they simply go to other sites), if the quality of the site is lower there could be some loss in consumer's surplus (no change in activity, so no change in income and employment). If it costs more to get to the substitute sites, there could still be increases in costs and thus lower consumer's surplus to users and profits to charter/party businesses. If there is not an adequate supply of substitute sites, then there could be losses in total activity and in all the non-market and market economic measures referenced in our above analysis of displaced use. The possibilities for substitution vary by alternative.

The presence of other closed areas will also effect the ability of displaced users to substitute. There are currently regions of closure in the study area in addition to the reserve areas proposed in this process. However to mitigate the negative impacts of the proposed areas, these are either being completely or partially re-opened. The effect this will have on the ability of users to find adequate substitutes site will vary by alternative. This issue is addressed below, where appropriate.

Long-term benefits from Replenishment Effects. Marine reserve systems may have beneficial effects beyond the direct ecological protection for the sites themselves. That is, both the size and number of fish, lobster and other invertebrates both inside and outside the reserves may increase. The quote from Davis 1998 summarizes some key aspects as they relate to recreation and marine reserve systems (for updated information, see the science panel's report):

> "…we found 31 studies that tested whether protected areas had an effect on the size, reproductive output, diversity, and recruitment of fish in adjacent areas. Fisheries targeted species were two to 25 times more abundant in no-take areas than in surrounding areas for fish, crustaceans, and mollusks on coral and temperate reefs in Australia, New Zealand, the Philippines, Japan, Kenya, South Africa, the Mediterranean Sea, Venezuela, Chile, and the United States (California, Florida and Rhode Island). Mean sizes of fished species protected in no-take zones were 12 to 200 percent larger than those in surrounding areas for all fishes studied and in 75 to 78 percent of the invertebrates. Eighty-six percent of the studies that tested fishery yields found that catches within three kilometers of the marine protected areas were 46 to 50 percent higher than before no-take zones were created. It is clear that fishers all over the world believe no-take zones increase yields because they fish as close to the boundaries as possible."

In addition, a study by Roberts, et. al. (2001) included the effects of no-take areas on recreational fishing specifically, in the Merritt Island National Wildlife Refuge at Cape Canaveral Florida. The refuge was established for security reasons relating to the Kennedy Space Center and includes two areas that have been closed to fishing since 1962. Among the findings in Roberts, et. al. (2001) is the following.

> "This region encompasses only 13% of the Florida coast, but of world record-size fish caught in Florida between 1939 and 1999, it accounted for 62% of 39 records for black drum, 54% of 67 records for red drum, 50% of 32 records for spotted sea trout, but only 2% of 84 records for common snook."

The explanation of the common snook finding is that the reserve is at the margin of its range and it does not spend the entire year in the refuge. The number of records for black and red drum are not only greater around the reserve than the rest of Florida, they are also increasing at a faster rate. Thus, marine reserves can be a benefit to recreational anglers. The study concluded the size and longevity of a reserve is fundamental to its success and that the effects of reserve extend beyond reserve boundaries.

The long-term benefits from the reserve could offset short-term costs from displacement, There would likely be long-term net benefits where short-term costs would be offset by long-term benefits. Again, this conclusion may still vary by alternative.

Table 3.3. Recreational Consumptive Activities: Impacts Relative to Step 1 Analysis

Factors	Short-term	Long-term
1. Status of Fishing Stocks	O	O to □
2. Replenishment Effects	□	■
3. Substitution/Relcoation	O to □	O to □
4. Crowding/Congestion Effects	●	●
5. Quality Increases in Marine Reserves	O	O
6. Other Regulations		
a) Regulated Inefficiency	□	□
b) Proposition 132 (Gillnet Restriction)	●	●
c) Allocations to Other User Groups	●	●
d) Cowcod Closure	●	□
e) Opening up some Cowcod Closure Areas	□	□
f) MLPA - Closed Areas	O	O
g) MLMA Fishery Management Plans	O	O
h) ITQs currently not being considered	O	O
I) Existing Area Closures	O to □	O to □
j) Temporal Closures	●	●
k) Economic Conditions and Outside and Internal Forces	●	●
7. Pelagic Species	□	□
8. Phasing	□	□
All Factors	O to ●	□ to ■

O = Neutral Impact
● = Increase in costs from Step 1
□ = Decrease in costs from Step 1
■ = No costs from Step 1 - instead, benefits

Preferred Alternative. This alternative is mid-ranged among the marine reserves in both size and impact on recreational consumptive activities. It covers 25 percent of the CINMS. In the short-term, complete mitigation by substituting to alternative sites is not likely for the Preferred Alternative because it encompasses areas of intense use. Mitigation by substituting to alternative sites is less likely for the preferred alternative in comparison to Alternatives 1, 2 and 3 because of its relative size and because it encompasses areas of more intense use. The portions of the Preferred Alternative to the north of Anacapa Island and on the northeast side of Santa Cruz Island as well as the area to the immediate southeast of Santa Barbara Island encompass a particularly high usage area for consumptive activities. Mitigation by substituting to alternative sites is more likely for the preferred alternative in comparison to Alternatives 4 and 5. In the Santa Barbara Island area, the Cowcod Conservation Area completely encompasses the study area. In addition to the Rockfish and Lingcod Management Area regulations, the Cowcod closure also prohibits the catch of certain species in waters 20 fathoms or greater. Several of these species were in the top twenty recreational species in terms of catch in 2000 (NMFS, 2002). There is a proposal to re-open an area of the Cowcod closure to the northeast of Santa Barbara Island. Because data is not available by species, the effect of this proposed action can not be quantified; however, it is expected that this will have a

positive effect on the ability of users to find an adequate substitute site. In the short-term, impacts should be less than estimated in the Step 1 Analysis.

In the long-term, the possibility of net benefits to consumptive users in the establishment of the Preferred Alternative depends upon consumptive users' success in finding substitute sites and the long-term resolution of crowding/congestion effects. As mentioned above, no take areas result in benefits that extend beyond the reserve boundaries (Roberts et. al., 2001). The number of interacting variables in marine ecosystems precludes accurate predictions of the magnitude of potential changes in abundance of target species. However, preliminary attempts to model ecosystems with reserve management have suggested that large reserves provide significantly greater benefits to target species than small reserves and limited-take zones (Salomon et al. 2002). Reserves established in areas of high recreational use are most likely to provide benefits to target species and long-term benefits to recreational fisherman. When intense fishing pressure is reduced in areas of high productivity, target species in reserves are likely to increase rapidly in abundance and individual size, leading to significantly higher reproductive potential. Increases in density and reproductive potential are likely to contribute to export of larvae and spillover of adult fish that will help to offset the loss of recreational fishing grounds.

Alternative 1. This alternative is the smallest of those being considered, both in terms of area and impact to recreational consumptive users. The success of relocation effort and substituting to alternative sites has higher probability for this alternative than for the Preferred Alternative because of the relatively small size of the alternative and because it does not contain a high proportion of heavily used areas for any of the consumptive activities. Furthermore, the highest use areas surrounding Anacapa Island and the east side of Santa Cruz Island are not as heavily impacted as other areas that are less used by consumptive users. The potential for crowding/congestion effects would also be low, again because of the relatively small size and the location of the alternative. One other potentially mitigating factor is the existing Anacapa Island Ecological Reserve, which prohibits the take of invertebrates. There is a proposal to re-open this reserve. This will have a positive effect on the ability of consumptive divers to relocate to adequate substitute sites. In the short-term, impacts should be less than estimated in the Step 1 Analysis.

In the long-term, depending upon consumptive users' success in finding substitute sites combined with an increase in size and quantity of sport fish in areas adjacent to marine reserves, there may actually be a net benefit to consumptive users. The number of interacting variables in marine ecosystems precludes accurate predictions of the magnitude of potential changes in abundance of target species. However, preliminary attempts to model ecosystems with reserve management have suggested that large reserves provide significantly greater benefits to target species than small reserves and limited-take zones (Salomon et al. 2002). Protecting the reserve areas proposed as Alternative 1 is not likely to contribute to recreational fisheries through of larval export and spillover. In other words, export from reserves will be diluted because the reserve area is small relative to the fished area. Individual reserves, particularly those on the north sides of Santa Rosa, Santa Cruz and Anacapa, are not likely to provide sufficient protection to reduce mortality and sustain local populations of some exploited species.

Alternative 2. In the short term, complete mitigation by substituting to alternative sites is less likely for alternative 2 in comparison to Alternative 1 because it encompasses areas of more intense use. Consumptive Fishers (both charter/party and private household boat) are more likely than divers to find a substitute site because Alternative 2 encompass relatively less of their current usage distribution. The portions of Alternative 2 to the north of Anacapa Island and on the northeast side of Santa Cruz Island encompass a particularly high usage area for charter/party and private boat diving. The potential for crowding/congestion effects would also be higher, again because of the relatively larger size and the location of the alternative. In the short-term, impacts should be less than estimated in the Step 1 Analysis.

Because Alternative 2 is of a larger size, the assumption is made that the increases in abundance and size of fish will be higher in magnitude in the long-term. As mentioned above, no take areas result in benefits that extend beyond the reserve boundaries (Roberts et. al., 2001). The number of interacting variables in marine ecosystems precludes accurate predictions of the magnitude of potential changes in abundance of target species. However, preliminary attempts to model ecosystems with reserve management have suggested that large reserves provide significantly greater benefits to target species than small reserves and limited-

take zones (Salomon et al. 2002). Protecting the reserve areas proposed as Alternative 2 is not likely to contribute to fisheries through of larval export and spillover. In other words, export from reserves will be diluted because the reserve area is small relative to the fished area. Individual reserves, particularly those on the north sides of Santa Rosa, Santa Cruz and Anacapa, are not likely to provide sufficient protection to reduce mortality and sustain local populations of some exploited species.

Alternative 3. Mitigation of losses from Alternative 3 is more likely than for the Preferred Alternative in the short term. The most important reason for this is the siting of the reserves. The area of intense use for consumptive activities to the north of Anacapa Island and the east side of Santa Cruz Island are not included in this Alternative. For the relatively small number of users operating in Alternative 3, successful substitution is likely. In addition to no encompassing high use areas, Alternative 3 is smaller than the Preferred Alternative, which gives users more options in their choice of substitutes. The potential for crowding/congestion effects would also be low, again because of the relatively small size and the location of the alternative. One other potentially mitigating factor is the existing Anacapa Island Ecological Reserve, which prohibits the take of invertebrates. There is a proposal to re-open this reserve. This will have a positive effect on the ability of consumptive divers to relocate to adequate substitute sites. In the short term, impacts should be less than estimated in the Step 1 Analysis.

For the same reasons that mitigation of losses would be more likely in the short term, benefits from replenishment effects will be smaller in the long term. Because Alternative 3 is of a smaller size, the assumption is made that the increases in abundance and size of fish will be lower in magnitude. However, for Alternative 3, the relative small size and the high likelihood of substitution would result in a higher probability of a positive - albeit smaller - net benefit to consumptive users.

Alternative 4. In the short term, complete mitigation by substituting to alternative sites is less likely for alternative 4 in comparison to the Preferred Alternative because it is larger and encompasses areas of more intense use. Both those participating in consumptive fishing and consumptive diving would be less likely to find a substitute sight based upon the current distribution of use. Crowding/congestion effects are expected to be higher for this alternative. The portions of Alternative 4 to the north of Anacapa Island and on the northeast side of Santa Cruz Island encompass a particularly high usage area. Additionally, Alternative 4 encompasses the high use areas surrounding Santa Barbara Island. The potential for crowding/congestion effects would also be higher, again because of the relatively larger size and the location of the alternative. The re-opening of the region of the Cowcod Conservation Area to the northeast of Santa Barbara Island may have a positive effect on the ability of users to find adequate substitute sites. Overall, some substitution will likely take place, so even in the short-term, estimated impacts are expected to be less than estimated in the Step 1 Analysis

As was mentioned above, the size of a reserve is fundamental to its effectiveness (Roberts et. al., 2001). Because Alternative 4 is of a larger size, the assumption is made that the increases in abundance and size of fish will be higher in magnitude, resulting in a positive influence on the long-term net benefit. Reserves established in areas of high recreational use are most likely to provide benefits to target species and long-term benefits to recreational fisherman. When intense fishing pressure is reduced in areas of high productivity, target species in reserves are likely to increase rapidly in abundance and individual size, leading to significantly higher reproductive potential. Increases in density and reproductive potential are likely to contribute to export of larvae and spillover of adult fish that will help to offset the loss of recreational fishing grounds. In the long-term, it is highly likely that this alternative will result in net benefits to consumptive recreation users.

Alternative 5. Because it is larger and because it covers more of the area that is important to consumptive users generally, mitigation by substituting to alternative sites is less likely for alternative 5 than for the Preferred Alternative. Both those participating in consumptive fishing and consumptive diving would be less likely to find a substitute sight based upon the current distribution of use. Specifically, Alternative 5 covers more of the area around Anacapa Island, the east side of Santa Cruz Island and a much larger area around Santa Barbara Island. The potential for crowding/congestion effects would also be higher, again because of the relatively larger size and the location of the alternative. The re-opening of the region of the Cowcod Conservation Area to the northeast of Santa Barbara Island may have a positive short-term effect

on the ability of users to find adequate substitute sites. Because data is not available by species, the effect of this proposed action can not be quantified; however, it is expected to be a mitigating factor. Although substitution is not likely to lead to full mitigation of costs, some substitution is expected to occur, resulting in lower impacts than estimated in the Step 1 Analysis.

Because Alternative 5 is of a larger size, the assumption is made that the increases in abundance and size of fish will be higher in magnitude in the long-term. The number of interacting variables in marine ecosystems precludes accurate predictions of the magnitude of potential changes in abundance of target species. However, preliminary attempts to model ecosystems with reserve management have suggested that large reserves provide significantly greater benefits to target species than small reserves and limited-take zones (Salomon et al. 2002).

Reserves established in areas of high recreational use are most likely to provide benefits to target species and long-term benefits to recreational fisherman. When intense fishing pressure is reduced in areas of high productivity, target species in reserves are likely to increase rapidly in abundance and individual size, leading to significantly higher reproductive potential. Increases in density and reproductive potential are likely to contribute to export of larvae and spillover of adult fish that will help to offset the loss of recreational fishing grounds.

Recreation Non-consumptive Users – Step 2 Analysis

In addition to benefits derived from replenishment effects, the establishment of marine reserve systems is expected to result in benefits to non-consumptive recreational users. These increased benefits take the form of increases in diversity of wildlife, viewing opportunities from increased abundance of fish and invertebrates, water quality, etc. Benefits may also be derived from the decrease in the density of users or in the reduction in conflicts with consumptive users. There is no data currently available to directly estimate the magnitude of these benefits. In light of this fact a simulation is conducted for each alternative using a range of increases in quality and of elasticities. In a paper by Smith and Kaoru (1990), about 200 recreation value studies were summarized using meta analysis. One of the elements compiled from this review was own price elasticity of demand. We use this range of elasticities as a proxy for quality elasticities (demand shifters) instead of price elasticities in our simulations. Using this range and the assumption of a 10%, 50% and 100% increase in quality, benefit estimates were calculated for each alternative. To avoid skewed results from outliers, the highest and lowest elasticities were dropped from this range.

For each alternative, four tables are provided. The first three tables report baseline 1999 activity within each alternative and their corresponding economic impact. The fourth table presents a range of potential impacts using our range of quality increases and quality elasticities. Quality increases are expected to grow over time. Elasticities also have a time dimension and in the short-term are smaller (less behavioral response to quality) and larger over the long-term (greater behavioral response). The number in the upper left corner of the tables reflects the smallest changes and the lower right corner of the tables yield the largest potential changes.

One other important point to bear in mind is that data was only available for charter/party boat non-consumptive recreation. This section does not take into account private boat non-consumptive usage, for which there was no data available. Therefore estimates of aggregate benefits presented here will tend to underestimate true benefits due to the exclusion of private boat non-consumptive usage in the calculations.

In the years 1999-2000, it is estimated that 6.3 million people age 16 or older from U.S. households participated in either bird watching, viewing other wildlife, viewing scenery or doing photography in the marine environment of California. They spent over 120.2 million days in these activities (Leeworthy 2001b and Leeworthy and Wiley 2001c)[6]. As a comparison, the same study estimated 2.7 million particiapnts that participated in 20.3 million days of saltwater recreational fishing. Given the above estiamtes, the private boat non-consumptive usage of the CINMS may be quite large.

Preferred Alternative. The aggregate economic impact on income associated with all non-consumptive activities is about $1.04 million dollars or 17.3% of the income generated in the study area. In terms of income, the activity with the highest baseline is whale watching with a baseline of $579 thousand, followed by non-consumptive diving with $327 thousand, sailing with $71 thousand and kayaking/sightseeing with $66 thousand. Please see Tables 3.4 through 3.6 the remainder of the economic measures and breakout by jurisdiction.

Table 3.4. Economic Impact Associated with Non-consumptive Activities Preferred Alternative - Total (Baseline 1999)

	Whale Watching		NC Diving		Sailing		Kayaking/Sightseeing	
	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]
Person-days	4,105	15.80%	2,197	20.39%	499	12.42%	357	28.96%
Market Impact								
Direct Sales	$ 682,449	15.9%	$ 382,600	20.6%	$ 86,775	12.5%	$ 74,647	29.0%
Direct Wages and Salaries	$ 330,700	15.9%	$ 186,889	20.8%	$ 40,468	12.4%	$ 37,477	29.0%
Direct Employment	11	15.2%	6	20.4%	1	12.4%	2	29.0%
Total Income								
Upper Bound	$ 578,724	15.9%	$ 327,056	20.8%	$ 70,820	12.4%	$ 65,585	29.0%
Lower Bound	$ 496,050	15.9%	$ 280,333	20.8%	$ 60,702	12.4%	$ 56,216	29.0%
Total Employment								
Upper Bound	16	15.3%	10	20.2%	2	12.2%	2	28.5%
Lower Bound	14	15.3%	8	20.3%	2	12.5%	2	27.1%
Non-Market Impact								
Consumer's Surplus	$ 47,530	15.8%	$ 25,443	20.4%	$ 5,774	12.4%	$ 4,135	29.0%
Profit[1]	$ 19,907	12.7%	$ 9,290	20.1%	$ 2,549	14.1%	$ 799	28.9%

1. Profit is used as a proxy for producer's surplus.

Table 3.5. Economic Impact Associated with Non-consumptive Activities - Preferred Alternative - State Waters (Baseline 1999)

	Whale Watching		NC Diving		Sailing		Kayaking/Sightseeing	
	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]
Person-days	3,787	14.57%	1,972	18.30%	440	10.96%	357	28.96%
Market Impact								
Direct Sales	$ 629,435	14.7%	$ 342,533	18.4%	$ 76,877	11.1%	$ 74,647	29.0%
Direct Wages and Salaries	$ 305,042	14.6%	$ 167,288	18.6%	$ 35,679	10.9%	$ 37,477	29.0%
Direct Employment	10	14.0%	6	18.3%	1	10.9%	2	29.0%
Total Income								
Upper Bound	$ 533,824	14.6%	$ 292,754	18.6%	$ 62,438	10.9%	$ 65,585	29.0%
Lower Bound	$ 457,563	14.6%	$ 250,932	18.6%	$ 53,518	10.9%	$ 56,216	29.0%
Total Employment								
Upper Bound	15	14.1%	9	18.2%	2	10.8%	2	28.5%
Lower Bound	13	14.1%	7	18.2%	1	11.0%	2	27.1%
Non-Market Impact								
Consumer's Surplus	$ 43,848	14.6%	$ 22,837	18.3%	$ 5,096	11.0%	$ 4,135	29.0%
Profit[1]	$ 18,509	11.8%	$ 8,278	17.9%	$ 2,418	13.4%	$ 799	28.9%

1. Profit is used as a proxy for producer's surplus.

Table 3.6. Economic Impact Associated with Non-consumptive Activities - Preferred Alternative - Federal Waters (Baseline 1999)

	Whale Watching		NC Diving		Sailing		Kayaking/Sightseeing	
	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]
Person-days	318	1.22%	225	2.09%	59	1.46%	-	0.00%
Market Impact								
Direct Sales	$ 53,014	1.2%	$ 40,067	2.2%	$ 9,897	1.4%	$ -	0.0%
Direct Wages and Salaries	$ 25,658	1.2%	$ 19,601	2.2%	$ 4,789	1.5%	$ -	0.0%
Direct Employment	1	1.2%	1	2.1%	0	1.5%	-	0.0%
Total Income								
Upper Bound	$ 44,901	1.2%	$ 34,301	2.2%	$ 8,381	1.5%	$ -	0.0%
Lower Bound	$ 38,486	1.2%	$ 29,401	2.2%	$ 7,184	1.5%	$ -	0.0%
Total Employment								
Upper Bound	1	1.2%	1	2.1%	0	1.4%	-	0.0%
Lower Bound	1	1.2%	1	2.1%	0	1.5%	-	0.0%
Non-Market Impact								
Consumer's Surplus	$ 3,682	1.2%	$ 2,606	2.1%	$ 678	1.5%	$ -	0.0%
Profit[1]	$ 1,399	0.9%	$ 1,012	2.2%	$ 131	0.7%	$ -	0.0%

1. Profit is used as a proxy for producer's surplus.

The above tables show the baseline economic impact of potential beneficiaries to the Preferred Alternative. Here, that logic is extended into a range of benefit scenarios described in the introduction to this section. Table 3.7 shows the range of benefits based on certain assumptions about the increase in quality and the value elasticity of quality. By quality, we are referring to a composite attribute that takes into consideration the range of benefits that would have an impact on the non-consumptive recreation experience. This includes such attributes as diversity of wildlife, abundance of fish and invertebrates, the decrease in the density of users, the increase in water quality, etc. We use a range of a 10% increase to a 100% increase in

quality. Value elasticity of quality is defined as the percentage increase in value associated with a one-percent increase in quality. For this illustration, we use a range of elasticities of 0.04 to 4.5. The valuation measure we use for this illustration is consumers' surplus associated with the boundary alternative, summed across all non-consumptive uses.

Table 3.7 presents a range of benefits with low end in terms of consumer's surplus of $332 with the assumption of a 10% increase in quality and a 0.04 value elasticity of quality and a high end of $372,969 with a 100% increase in value and a value elasticity of quality of 4.5. Income impacts range between $4,169 and $4,689,833, while employment impacts range between less than one job to 135 new jobs.

Table 3.7 Potential Benefits to Non-consumptive Users from The Preferred Alternative - Step 2 Analysis

Increase in Quality	Economic Measure	Elasticity of 0.04	Elasticity of 1.0	Elasticity of 4.5
10%				
	Consumer's Surplus	$ 332	$ 8,288	$ 37,297
	Income	$ 4,169	$ 104,219	$ 468,983
	Employment	0.12	3.00	13.50
	Person-days	29	716	3,221
50%				
	Consumer's Surplus	$ 1,658	$ 41,441	$ 186,485
	Income	$ 20,844	$ 521,093	$ 2,344,916
	Employment	0.60	15.00	67.50
	Person-days	143	3,579	16,106
100%				
	Consumer's Surplus	$ 3,315	$ 82,882	$ 372,969
	Income	$ 41,687	$ 1,042,185	$ 4,689,833
	Employment	1.20	30.00	135.00
	Person-days	286	7,158	32,211

1. Benefits are the aggregate amounts across all non-consumptive activities for The Preferred Alternative

Alternative 1. In terms of impact of non-consumptive activities this is the smallest marine reserve alternative. The aggregate economic impact on income associated with all non-consumptive activities in Alternative 1 is about $383 thousand dollars or 6.4% of the income generated in the study area. In terms of income, the activity with the highest baseline is whale watching with a baseline of $182 thousand, followed by non-consumptive diving with $145 thousand, sailing with $33 thousand and kayaking/sightseeing with $23 thousand. Please see Tables 3.8 through 3.10 the remainder of the economic measures and breakout by jurisdiction.

Table 3.8. Economic Impact Associated with Non-consumptive Activities - Alternative 1 - Total (Baseline 1999)

	Whale Watching		NC Diving		Sailing		Kayaking/Sightseeing	
	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]
Person-days	1,290	4.96%	1,042	9.67%	229	5.70%	126	10.19%
Market Impact								
Direct Sales	$ 214,264	5.0%	$ 169,595	9.1%	$ 38,651	5.6%	$ 26,492	10.3%
Direct Wages and Salaries	$ 103,868	5.0%	$ 82,767	9.2%	$ 18,703	5.7%	$ 13,315	10.3%
Direct Employment	3	4.8%	3	9.7%	1	5.7%	1	10.4%
Total Income								
Upper Bound	$ 181,769	5.0%	$ 144,842	9.2%	$ 32,731	5.7%	$ 23,301	10.3%
Lower Bound	$ 155,802	5.0%	$ 124,150	9.2%	$ 28,055	5.7%	$ 19,973	10.3%
Total Employment								
Upper Bound	5	4.8%	5	9.6%	1	5.6%	1	10.2%
Lower Bound	4	4.8%	4	9.6%	1	5.8%	1	9.7%
Non-Market Impact								
Consumer's Surplus	$ 14,936	5.0%	$ 12,067	9.7%	$ 2,648	5.7%	$ 1,455	10.2%
Profit[1]	$ 6,437	4.1%	$ 3,511	7.6%	$ 510	2.8%	$ 275	10.0%

1. Profit is used as a proxy for producer's surplus.

Table 3.9. Economic Impact Associated with Non-consumptive Activities - Alternative 1 - State Waters (Baseline 1999)

	Whale Watching		NC Diving		Sailing		Kayaking/Sightseeing	
	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]
Person-days	1,288	4.96%	937	8.69%	197	4.91%	126	10.19%
Market Impact								
Direct Sales	$ 213,891	5.0%	$ 151,064	8.1%	$ 33,296	4.8%	$ 26,492	10.3%
Direct Wages and Salaries	$ 103,687	5.0%	$ 73,702	8.2%	$ 16,112	4.9%	$ 13,315	10.3%
Direct Employment	3	4.8%	3	8.7%	1	4.9%	1	10.4%
Total Income								
Upper Bound	$ 181,453	5.0%	$ 128,978	8.2%	$ 28,196	4.9%	$ 23,301	10.3%
Lower Bound	$ 155,531	5.0%	$ 110,553	8.2%	$ 24,168	4.9%	$ 19,973	10.3%
Total Employment								
Upper Bound	5	4.8%	4	8.6%	1	4.8%	1	10.2%
Lower Bound	4	4.8%	3	8.7%	1	5.0%	1	9.7%
Non-Market Impact								
Consumer's Surplus	$ 14,910	5.0%	$ 10,848	8.7%	$ 2,281	4.9%	$ 1,455	10.2%
Profit[1]	$ 6,428	4.1%	$ 3,054	6.6%	$ 439	2.4%	$ 275	10.0%

1. Profit is used as a proxy for producer's surplus.

Table 3.10. Economic Impact Associated with Non-consumptive Activities - Alternative 1 - Federal Waters (Baseline 1999)

	Whale Watching		NC Diving		Sailing		Kayaking/Sightseeing	
	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]
Person-days	2	0.01%	105	0.98%	32	0.79%	-	0.00%
Market Impact								
Direct Sales	$ 373	0.0%	$ 18,531	1.0%	$ 5,355	0.8%	$ -	0.0%
Direct Wages and Salaries	$ 181	0.0%	$ 9,065	1.0%	$ 2,591	0.8%	$ -	0.0%
Direct Employment	0	0.0%	0	1.0%	0	0.8%	-	0.0%
Total Income								
Upper Bound	$ 316	0.0%	$ 15,864	1.0%	$ 4,535	0.8%	$ -	0.0%
Lower Bound	$ 271	0.0%	$ 13,598	1.0%	$ 3,887	0.8%	$ -	0.0%
Total Employment								
Upper Bound	0	0.0%	0	1.0%	0	0.8%	-	0.0%
Lower Bound	0	0.0%	0	1.0%	0	0.8%	-	0.0%
Non-Market Impact								
Consumer's Surplus	$ 26	0.0%	$ 1,219	1.0%	$ 367	0.8%	$ -	0.0%
Profit[1]	$ 9	0.0%	$ 457	1.0%	$ 71	0.4%	$ -	0.0%

1. Profit is used as a proxy for producer's surplus.

The above tables show the baseline economic impact of potential beneficiaries to Alternative 1. Here, that logic is extended into a range of benefit scenarios described in the introduction to this section. Table 3.11 shows the range of benefits based on certain assumptions about the increase in quality and the value elasticity of quality. By quality, we are referring to a composite attribute that takes into consideration the range of benefits that would have an impact on the non-consumptive recreation experience. This includes such attributes as diversity of wildlife, abundance of fish and invertebrates, the decrease in the density of users, the increase in water quality, etc. We use a range of a 10% increase to a 100% increase in quality. Value elasticity of quality is defined as the percentage increase in value associated with a one-percent increase in quality. For this illustration, we use a range of elasticities of 0.04 to 4.5. The valuation measure we use for this illustration is consumers' surplus associated with the boundary alternative, summed across all non-consumptive uses.

Table 3.11 presents a range of benefits with low end in terms of consumer's surplus of $124 with the assumption of a 10% increase in quality and a 0.04 value elasticity of quality and a high end of $139,977 with a 100% increase in value and a value elasticity of quality of 4.5. Income impacts increase to a range between $1,531 and $1,721,895, while employment impacts range between less than one job to 51 new jobs.

Table 3.11 Potential Benefits to Non-consumptive Users from Alternative 1 - Step 2 Analysis

Increase in Quality	Economic Measure	Elasticity of 0.04	Elasticity of 1.0	Elasticity of 4.5
10%				
	Consumer's Surplus	$ 124	$ 3,111	$ 13,998
	Income	$ 1,531	$ 38,264	$ 172,189
	Employment	0.05	1.14	5.14
	Person-days	11	269	1,209
50%				
	Consumer's Surplus	$ 622	$ 15,553	$ 69,989
	Income	$ 7,653	$ 191,322	$ 860,947
	Employment	0.23	5.72	25.72
	Person-days	54	1,344	6,046
100%				
	Consumer's Surplus	$ 1,244	$ 31,106	$ 139,977
	Income	$ 15,306	$ 382,643	$ 1,721,895
	Employment	0.46	11.43	51.44
	Person-days	107	2,687	12,092

1. Benefits are the aggregate amounts across all non-consumptive activities for Alterantive 1

Alternative 2. In terms of impact associated with non-consumptive activities Alternative 2 is slightly larger than the Preferred Alternative. The aggregate economic impact on income associated with all non-consumptive activities is about $1.03 million dollars or 17.1% of the income generated in the study area. In terms of income, the activity with the highest baseline is whale watching with $635 thousand, followed by non-consumptive diving with $295 thousand, sailing with $77 thousand and kayaking/sightseeing with $23 thousand. Please see Tables 3.12 through 3.14 the remainder of the economic measures and breakout by jurisdiction.

Table 3.12. Economic Impact Associated with Non-consumptive Activities - Alternative 2 - Total (Baseline 1999)

	Whale Watching		NC Diving		Sailing		Kayaking/Sightseeing	
	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]
Person-days	4,503	17.33%	1,984	18.41%	540	13.44%	130	10.54%
Market Impact								
Direct Sales	$ 748,574	17.5%	$ 346,919	18.7%	$ 91,179	13.1%	$ 26,627	10.3%
Direct Wages and Salaries	$ 362,749	17.4%	$ 168,585	18.7%	$ 44,122	13.5%	$ 13,333	10.3%
Direct Employment	12	16.7%	6	18.4%	1	13.5%	1	10.2%
Total Income								
Upper Bound	$ 634,811	17.4%	$ 295,024	18.7%	$ 77,213	13.5%	$ 23,332	10.3%
Lower Bound	$ 544,123	17.4%	$ 252,878	18.7%	$ 66,183	13.5%	$ 19,999	10.3%
Total Employment								
Upper Bound	18	16.7%	9	18.3%	2	13.3%	1	10.0%
Lower Bound	15	16.7%	7	18.4%	2	13.6%	1	9.5%
Non-Market Impact								
Consumer's Surplus	$ 52,138	17.3%	$ 22,971	18.4%	$ 6,247	13.4%	$ 1,504	10.5%
Profit[1]	$ 21,867	13.9%	$ 8,725	18.8%	$ 1,203	6.7%	$ 305	11.0%

1. Profit is used as a proxy for producer's surplus.

Table 3.13. Economic Impact Associated with Non-consumptive Activities - Alternative 2 - State Waters (Baseline 1999)

	Whale Watching		NC Diving		Sailing		Kayaking/Sightseeing	
	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]
Person-days	4,079	15.70%	1,821	16.90%	482	12.00%	130	10.54%
Market Impact								
Direct Sales	$ 677,801	15.8%	$ 317,349	17.1%	$ 81,425	11.7%	$ 26,627	10.3%
Direct Wages and Salaries	$ 328,537	15.8%	$ 154,119	17.1%	$ 39,402	12.1%	$ 13,333	10.3%
Direct Employment	11	15.2%	5	16.9%	1	12.0%	1	10.2%
Total Income								
Upper Bound	$ 574,941	15.8%	$ 269,708	17.1%	$ 68,953	12.1%	$ 23,332	10.3%
Lower Bound	$ 492,806	15.8%	$ 231,178	17.1%	$ 59,103	12.1%	$ 19,999	10.3%
Total Employment								
Upper Bound	16	15.2%	8	16.8%	2	11.8%	1	10.0%
Lower Bound	14	15.2%	7	16.9%	2	12.1%	1	9.5%
Non-Market Impact								
Consumer's Surplus	$ 47,235	15.7%	$ 21,090	16.9%	$ 5,579	12.0%	$ 1,504	10.5%
Profit[1]	$ 20,188	12.8%	$ 7,946	17.2%	$ 1,074	6.0%	$ 305	11.0%

1. Profit is used as a proxy for producer's surplus.

Table 3.14. Economic Impact Associated with Non-consumptive Activities - Alternative 2 - Federal Waters (Baseline 1999)

	Whale Watching		NC Diving		Sailing		Kayaking/Sightseeing	
	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]
Person-days	423	1.63%	162	1.51%	58	1.44%	-	0.00%
Market Impact								
Direct Sales	$ 70,772	1.7%	$ 29,569	1.6%	$ 9,754	1.4%	$ -	0.0%
Direct Wages and Salaries	$ 34,211	1.6%	$ 14,467	1.6%	$ 4,720	1.4%	$ -	0.0%
Direct Employment	1	1.5%	0	1.5%	0	1.4%	-	0.0%
Total Income								
Upper Bound	$ 59,870	1.6%	$ 25,316	1.6%	$ 8,260	1.4%	$ -	0.0%
Lower Bound	$ 51,317	1.6%	$ 21,700	1.6%	$ 7,080	1.4%	$ -	0.0%
Total Employment								
Upper Bound	2	1.5%	1	1.5%	0	1.4%	-	0.0%
Lower Bound	1	1.5%	1	1.5%	0	1.5%	-	0.0%
Non-Market Impact								
Consumer's Surplus	$ 4,903	1.6%	$ 1,881	1.5%	$ 668	1.4%	$ -	0.0%
Profit[1]	$ 1,679	1.1%	$ 780	1.7%	$ 129	0.7%	$ -	0.0%

1. Profit is used as a proxy for producer's surplus.

The above tables show the baseline economic impact of potential beneficiaries to Alternative 2. Here, that logic is extended into a range of benefit scenarios described in the introduction to this section. Table 3.15 shows the range of benefits based on certain assumptions about the increase in quality and the value elasticity of quality. By quality, we are referring to a composite attribute that takes into consideration the range of benefits that would have an impact on the non-consumptive recreation experience. This includes such attributes as diversity of wildlife, abundance of fish and invertebrates, the decrease in the density of users, the increase in water quality, etc. We use a range of a 10% increase to a 100% increase in quality. Value elasticity of quality is defined as the percentage increase in value associated with a one-percent increase in quality. For this illustration, we use a range of elasticities of 0.04 to 4.5. The valuation measure we use for this illustration is consumers' surplus associated with the boundary alternative, summed across all non-consumptive uses.

Table 3.15 presents a range of benefits with low end in terms of consumer's surplus of $331 with the assumption of a 10% increase in quality and a 0.04 value elasticity of quality and a high end of $372,875 with a 100% increase in value and a value elasticity of quality of 4.5. Income impacts increase to a range between $4,122 and $4,636,710, while employment impacts range between less than one job to 133 new jobs.

Table 3.15 Potential Benefits to Non-consumptive Users from Alternative 2 - Step 2 Analysis

Increase in Quality	Economic Measure	Elasticity of 0.04	Elasticity of 1.0	Elasticity of 4.5
10%				
	Consumer's Surplus	$ 331	$ 8,286	$ 37,287
	Income	$ 4,122	$ 103,038	$ 463,671
	Employment	0.12	2.96	13.32
	Person-days	29	716	3,220
50%				
	Consumer's Surplus	$ 1,657	$ 41,431	$ 186,437
	Income	$ 20,608	$ 515,190	$ 2,318,355
	Employment	0.59	14.80	66.60
	Person-days	143	3,578	16,101
100%				
	Consumer's Surplus	$ 3,314	$ 82,861	$ 372,875
	Income	$ 41,215	$ 1,030,380	$ 4,636,710
	Employment	1.18	29.60	133.21
	Person-days	286	7,156	32,202

1. Benefits are the aggregate amounts across all non-consumptive activities for Alterantive 2

Alternative 3. In terms of impact associated with non-consumptive activities Alternative 3 is significantly smaller than the preferred alternative. The aggregate economic impact on income associated with all non-consumptive activities is about $384 thousands dollars or 6.4% of the income generated in the study area. In terms of income, the activity with the highest baseline is non-consumptive diving with $164 thousand, followed by whale watching with $156 thousand, sailing with $37 thousand and kayaking/sightseeing with $25 thousand. Please see Tables 3.16 through 3.18 the remainder of the economic measures and breakout by jurisdiction.

Table 3.16. Economic Impact Associated with Non-consumptive Activities - Alternative 3 - Total (Baseline 1999)

	Whale Watching		NC Diving		Sailing		Kayaking/Sightseeing	
	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]
Person-days	1,112	4.28%	1,175	10.90%	264	6.57%	136	11.00%
Market Impact								
Direct Sales	$ 183,670	4.3%	$ 192,526	10.4%	$ 44,589	6.4%	$ 28,472	11.1%
Direct Wages and Salaries	$ 89,284	4.3%	$ 93,983	10.4%	$ 21,577	6.6%	$ 14,304	11.1%
Direct Employment	3	4.3%	3	10.9%	1	6.6%	1	11.1%
Total Income								
Upper Bound	$ 156,246	4.3%	$ 164,471	10.4%	$ 37,759	6.6%	$ 25,032	11.1%
Lower Bound	$ 133,926	4.3%	$ 140,975	10.4%	$ 32,365	6.6%	$ 21,456	11.1%
Total Employment								
Upper Bound	5	4.3%	5	10.8%	1	6.5%	1	10.9%
Lower Bound	4	4.3%	4	10.9%	1	6.6%	1	10.4%
Non-Market Impact								
Consumer's Surplus	$ 12,881	4.3%	$ 13,605	10.9%	$ 3,055	6.6%	$ 1,570	11.0%
Profit[1]	$ 6,660	4.2%	$ 4,054	8.8%	$ 588	3.3%	$ 300	10.8%

1. Profit is used as a proxy for producer's surplus.

Table 3.17. Economic Impact Associated with Non-consumptive Activities - Alternative 3 - State Waters (Baseline 1999)

	Whale Watching		NC Diving		Sailing		Kayaking/Sightseeing	
	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]
Person-days	1,108	4.26%	975	9.05%	232	5.78%	136	11.00%
Market Impact								
Direct Sales	$ 182,925	4.3%	$ 157,141	8.5%	$ 39,234	5.7%	$ 28,472	11.1%
Direct Wages and Salaries	$ 88,920	4.3%	$ 76,673	8.5%	$ 18,985	5.8%	$ 14,304	11.1%
Direct Employment	3	4.3%	3	9.0%	1	5.8%	1	11.1%
Total Income								
Upper Bound	$ 155,610	4.3%	$ 134,178	8.5%	$ 33,224	5.8%	$ 25,032	11.1%
Lower Bound	$ 133,380	4.3%	$ 115,010	8.5%	$ 28,478	5.8%	$ 21,456	11.1%
Total Employment								
Upper Bound	5	4.3%	4	9.0%	1	5.7%	1	10.9%
Lower Bound	4	4.3%	4	9.0%	1	5.8%	1	10.4%
Non-Market Impact								
Consumer's Surplus	$ 12,828	4.3%	$ 11,287	9.0%	$ 2,688	5.8%	$ 1,570	11.0%
Profit[1]	$ 6,627	4.2%	$ 3,173	6.9%	$ 518	2.9%	$ 300	10.8%

1. Profit is used as a proxy for producer's surplus.

Table 3.18. Economic Impact Associated with Non-consumptive Activities - Alternative 3 - Federal Waters (Baseline 1999)

	Whale Watching		NC Diving		Sailing		Kayaking/Sightseeing	
	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]
Person-days	5	0.02%	200	1.86%	32	0.79%	-	0.00%
Market Impact								
Direct Sales	$ 746	0.0%	$ 35,385	1.9%	$ 5,355	0.8%	$ -	0.0%
Direct Wages and Salaries	$ 364	0.0%	$ 17,310	1.9%	$ 2,591	0.8%	$ -	0.0%
Direct Employment	0	0.0%	1	1.9%	0	0.8%	-	0.0%
Total Income								
Upper Bound	$ 637	0.0%	$ 30,292	1.9%	$ 4,535	0.8%	$ -	0.0%
Lower Bound	$ 546	0.0%	$ 25,965	1.9%	$ 3,887	0.8%	$ -	0.0%
Total Employment								
Upper Bound	0	0.0%	1	1.8%	0	0.8%	-	0.0%
Lower Bound	0	0.0%	1	1.9%	0	0.8%	-	0.0%
Non-Market Impact								
Consumer's Surplus	$ 53	0.0%	$ 2,318	1.9%	$ 367	0.8%	$ -	0.0%
Profit[1]	$ 33	0.0%	$ 881	1.9%	$ 71	0.4%	$ -	0.0%

1. Profit is used as a proxy for producer's surplus.

The above tables show the baseline economic impact of potential beneficiaries to Alternative 3. Here, that logic is extended into a range of benefit scenarios described in the introduction to this section. Table 3.19 shows the range of benefits based on certain assumptions about the increase in quality and the value elasticity of quality. By quality, we are referring to a composite attribute that takes into consideration the range of benefits that would have an impact on the non-consumptive recreation experience. This includes such attributes as diversity of wildlife, abundance of fish and invertebrates, the decrease in the density of users, the increase in water quality, etc. We use a range of a 10% increase to a 100% increase in quality. Value elasticity of quality is defined as the percentage increase in value associated with a one-percent increase in quality. For this illustration, we use a range of elasticities of 0.04 to 4.5. The valuation measure we use for this illustration is consumers' surplus associated with the boundary alternative, summed across all non-consumptive uses.

Table 3.19 presents a range of benefits with low end in terms of consumer's surplus of $124 with the assumption of a 10% increase in quality and a 0.04 value elasticity of quality and a high end of $139,995 with a 100% increase in value and a value elasticity of quality of 4.5. Income impacts increase to a range between $1,534 and $1,725,785, while employment impacts range between less than one job to 52 new jobs.

Table 3.19 Potential Benefits to Non-consumptive Users from Alternative 3 - Step 2 Analysis

Increase in Quality	Economic Measure	Elasticity of 0.04	Elasticity of 1.0	Elasticity of 4.5
10%				
	Consumer's Surplus	$ 124	$ 3,111	$ 14,000
	Income	$ 1,534	$ 38,351	$ 172,578
	Employment	0.05	1.16	5.23
	Person-days	11	269	1,209
50%				
	Consumer's Surplus	$ 622	$ 15,555	$ 69,998
	Income	$ 7,670	$ 191,754	$ 862,892
	Employment	0.23	5.82	26.17
	Person-days	54	1,344	6,046
100%				
	Consumer's Surplus	$ 1,244	$ 31,110	$ 139,995
	Income	$ 15,340	$ 383,508	$ 1,725,785
	Employment	0.47	11.63	52.34
	Person-days	107	2,687	12,092

1. Benefits are the aggregate amounts across all non-consumptive activities for Alterantive 3

Alternative 4. In terms of impact associated with non-consumptive activities Alternative 4 is larger than the Preferred Alternative. The aggregate economic impact on income associated with all non-consumptive activities is about $1.3 million dollars or 20.8% of the income generated in the study area. In terms of income, the activity with the highest baseline is whale watching with $767 thousand, followed by non-consumptive diving with $370 thousand, sailing with $81 thousand and kayaking/sightseeing with $32 thousand. Please see Tables 3.20 through 3.22 the remainder of the economic measures and breakout by jurisdiction.

Table 3.20. Economic Impact Associated with Non-consumptive Activities - Alternative 4 - Total (Baseline 1999)

	Whale Watching		NC Diving		Sailing		Kayaking/Sightseeing	
	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]
Person-days	5,450	20.97%	2,505	23.25%	569	14.17%	174	14.13%
Market Impact								
Direct Sales	$ 903,539	21.1%	$ 434,389	23.4%	$ 97,837	14.1%	$ 36,097	14.0%
Direct Wages and Salaries	$ 438,372	21.0%	$ 211,439	23.5%	$ 46,329	14.2%	$ 18,101	14.0%
Direct Employment	15	20.5%	7	23.2%	1	14.2%	1	13.9%
Total Income								
Upper Bound	$ 767,151	21.0%	$ 370,018	23.5%	$ 81,076	14.2%	$ 31,676	14.0%
Lower Bound	$ 657,558	21.0%	$ 317,159	23.5%	$ 69,493	14.2%	$ 27,151	14.0%
Total Employment								
Upper Bound	22	20.6%	11	23.1%	2	13.9%	1	13.7%
Lower Bound	19	20.6%	9	23.2%	2	14.3%	1	13.0%
Non-Market Impact								
Consumer's Surplus	$ 63,099	21.0%	$ 29,005	23.2%	$ 6,589	14.2%	$ 2,018	14.1%
Profit[1]	$ 28,847	18.3%	$ 10,645	23.0%	$ 2,227	12.4%	$ 399	14.4%

1. Profit is used as a proxy for producer's surplus.

Table 3.21. Economic Impact Associated with Non-consumptive Activities - Alternative 4 - State Waters (Baseline 1999)

	Whale Watching		NC Diving		Sailing		Kayaking/Sightseeing	
	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]
Person-days	4,272	16.44%	2,194	20.36%	518	12.89%	174	14.13%
Market Impact								
Direct Sales	$ 709,897	16.6%	$ 378,420	20.4%	$ 89,135	12.8%	$ 36,097	14.0%
Direct Wages and Salaries	$ 344,085	16.5%	$ 184,058	20.5%	$ 42,118	12.9%	$ 18,101	14.0%
Direct Employment	11	15.9%	6	20.4%	1	12.9%	1	13.9%
Total Income								
Upper Bound	$ 602,149	16.5%	$ 322,101	20.5%	$ 73,706	12.9%	$ 31,676	14.0%
Lower Bound	$ 516,127	16.5%	$ 276,087	20.5%	$ 63,177	12.9%	$ 27,151	14.0%
Total Employment								
Upper Bound	17	15.9%	10	20.2%	2	12.7%	1	13.7%
Lower Bound	14	15.9%	8	20.3%	2	13.0%	1	13.0%
Non-Market Impact								
Consumer's Surplus	$ 49,469	16.4%	$ 25,407	20.4%	$ 5,993	12.9%	$ 2,018	14.1%
Profit[1]	$ 21,098	13.4%	$ 9,198	19.9%	$ 2,112	11.7%	$ 399	14.4%

1. Profit is used as a proxy for producer's surplus.

Table 3.22. Economic Impact Associated with Non-consumptive Activities - Alternative 4 - Federal Waters (Baseline 1999)

	Whale Watching		NC Diving		Sailing		Kayaking/Sightseeing	
	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]
Person-days	1,177	4.53%	311	2.88%	51	1.28%	-	0.00%
Market Impact								
Direct Sales	$ 193,641	4.5%	$ 55,968	3.0%	$ 8,702	1.3%	$ -	0.0%
Direct Wages and Salaries	$ 94,287	4.5%	$ 27,381	3.0%	$ 4,211	1.3%	$ -	0.0%
Direct Employment	3	4.6%	1	2.9%	0	1.3%	-	0.0%
Total Income								
Upper Bound	$ 165,003	4.5%	$ 47,917	3.0%	$ 7,369	1.3%	$ -	0.0%
Lower Bound	$ 141,431	4.5%	$ 41,072	3.0%	$ 6,316	1.3%	$ -	0.0%
Total Employment								
Upper Bound	5	4.6%	1	2.9%	0	1.3%	-	0.0%
Lower Bound	4	4.6%	1	2.9%	0	1.3%	-	0.0%
Non-Market Impact								
Consumer's Surplus	$ 13,630	4.5%	$ 3,597	2.9%	$ 596	1.3%	$ -	0.0%
Profit[1]	$ 7,748	4.9%	$ 1,447	3.1%	$ 115	0.6%	$ -	0.0%

1. Profit is used as a proxy for producer's surplus.

The above tables show the baseline economic impact of potential beneficiaries to Alternative 4. Here, that logic is extended into a range of benefit scenarios described in the introduction to this section. Table 3.23 shows the range of benefits based on certain assumptions about the increase in quality and the value elasticity of quality. By quality, we are referring to a composite attribute that takes into consideration the range of benefits that would have an impact on the non-consumptive recreation experience. This includes such attributes as diversity of wildlife, abundance of fish and invertebrates, the decrease in the density of users, the increase in water quality, etc. We use a range of a 10% increase to a 100% increase in quality. Value elasticity of quality is defined as the percentage increase in value associated with a one-percent increase in quality. For this illustration, we use a range of elasticities of 0.04 to 4.5. The valuation measure we use for this illustration is consumers' surplus associated with the boundary alternative, summed across all non-consumptive uses.

Table 3.23 presents a range of benefits with low end in terms of consumer's surplus of $403 with the assumption of a 10% increase in quality and a 0.04 value elasticity of quality and a high end of $453,195 with a 100% increase in value and a value elasticity of quality of 4.5. Income impacts increase to a range between $5,000 and $5,624,646, while employment impacts range between less than one job to about 164 new jobs.

Table 3.23 Potential Benefits to Non-consumptive Users from Alternative 4 - Step 2 Analysis

Increase in Quality	Economic Measure	Elasticity of 0.04	Elasticity of 1.0	Elasticity of 4.5
10%				
	Consumer's Surplus	$ 403	$ 10,071	$ 45,320
	Income	$ 5,000	$ 124,992	$ 562,465
	Employment	0.15	3.64	16.37
	Person-days	35	870	3,914
50%				
	Consumer's Surplus	$ 2,014	$ 50,355	$ 226,598
	Income	$ 24,998	$ 624,961	$ 2,812,323
	Employment	0.73	18.19	81.85
	Person-days	174	4,349	19,571
100%				
	Consumer's Surplus	$ 4,028	$ 100,710	$ 453,195
	Income	$ 49,997	$ 1,249,921	$ 5,624,646
	Employment	1.46	36.38	163.70
	Person-days	348	8,698	39,141

1. Benefits are the aggregate amounts across all non-consumptive activities for Alterantive 4

Alternative 5. In terms of impact associated with non-consumptive activities Alternative 5 is significantly larger than the preferred alternative. The aggregate economic impact on income associated with all non-consumptive activities is about $1.5 million dollars or 25.5% of the income generated in the study area. In terms of income, the activity with the highest baseline is whale watching with $939 thousand, followed by non-consumptive diving with $431 thousand, sailing with $96 thousand and kayaking/sightseeing with $71 thousand. Please see Tables 3.24 through 3.26 the remainder of the economic measures and breakout by jurisdiction.

Table 3.24. Economic Impact Associated with Non-consumptive Activities - Alternative 5 - Total (Baseline 1999)

	Whale Watching		NC Diving		Sailing		Kayaking/Sightseeing	
	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]
Person-days	6,670	25.67%	2,901	26.93%	672	16.75%	386	31.31%
Market Impact								
Direct Sales	$ 1,104,869	25.8%	$ 504,751	27.2%	$ 116,137	16.7%	$ 80,471	31.3%
Direct Wages and Salaries	$ 536,287	25.7%	$ 246,032	27.3%	$ 54,677	16.8%	$ 40,387	31.2%
Direct Employment	18	25.2%	8	26.9%	2	16.8%	2	31.2%
Total Income								
Upper Bound	$ 938,502	25.7%	$ 430,556	27.3%	$ 95,685	16.8%	$ 70,676	31.2%
Lower Bound	$ 804,430	25.7%	$ 369,048	27.3%	$ 82,016	16.8%	$ 60,580	31.2%
Total Employment								
Upper Bound	27	25.3%	13	26.7%	3	16.5%	2	30.7%
Lower Bound	23	25.3%	10	26.8%	2	16.9%	2	29.2%
Non-Market Impact								
Consumer's Surplus	$ 77,233	25.7%	$ 33,594	26.9%	$ 7,786	16.7%	$ 4,470	31.3%
Profit[1]	$ 36,362	23.1%	$ 12,367	26.7%	$ 2,936	16.3%	$ 870	31.5%

1. Profit is used as a proxy for producer's surplus.

Table 3.25. Economic Impact Associated with Non-consumptive Activities - Alternative 5 - State Waters (Baseline 1999)

	Whale Watching		NC Diving		Sailing		Kayaking/Sightseeing	
	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]
Person-days	4,901	18.86%	2,542	23.59%	609	15.17%	386	31.31%
Market Impact								
Direct Sales	$ 814,227	19.0%	$ 439,779	23.7%	$ 105,427	15.2%	$ 80,471	31.3%
Direct Wages and Salaries	$ 394,686	18.9%	$ 214,245	23.8%	$ 49,494	15.2%	$ 40,387	31.2%
Direct Employment	13	18.2%	7	23.6%	2	15.2%	2	31.2%
Total Income								
Upper Bound	$ 690,701	18.9%	$ 374,930	23.8%	$ 86,615	15.2%	$ 70,676	31.2%
Lower Bound	$ 592,030	18.9%	$ 321,368	23.8%	$ 74,242	15.2%	$ 60,580	31.2%
Total Employment								
Upper Bound	20	18.3%	11	23.4%	2	14.9%	2	30.7%
Lower Bound	16	18.3%	9	23.5%	2	15.3%	2	29.2%
Non-Market Impact								
Consumer's Surplus	$ 56,749	18.9%	$ 29,428	23.6%	$ 7,052	15.2%	$ 4,470	31.3%
Profit[1]	$ 24,353	15.5%	$ 10,680	23.1%	$ 2,795	15.5%	$ 870	31.5%

1. Profit is used as a proxy for producer's surplus.

Table 3.26. Economic Impact Associated with Non-consumptive Activities - Alternative 5 - Federal Waters (Baseline 1999)

	Whale Watching		NC Diving		Sailing		Kayaking/Sightseeing	
	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]
Person-days	1,769	6.81%	360	3.34%	63	1.58%	-	0.00%
Market Impact								
Direct Sales	$ 290,642	6.8%	$ 64,973	3.5%	$ 10,710	1.5%	$ -	0.0%
Direct Wages and Salaries	$ 141,600	6.8%	$ 31,786	3.5%	$ 5,183	1.6%	$ -	0.0%
Direct Employment	5	7.0%	1	3.3%	0	1.6%	-	0.0%
Total Income								
Upper Bound	$ 247,801	6.8%	$ 55,626	3.5%	$ 9,070	1.6%	$ -	0.0%
Lower Bound	$ 212,401	6.8%	$ 47,680	3.5%	$ 7,774	1.6%	$ -	0.0%
Total Employment								
Upper Bound	8	7.0%	2	3.3%	0	1.6%	-	0.0%
Lower Bound	6	7.0%	1	3.3%	0	1.6%	-	0.0%
Non-Market Impact								
Consumer's Surplus	$ 20,483	6.8%	$ 4,166	3.3%	$ 734	1.6%	$ -	0.0%
Profit[1]	$ 12,009	7.6%	$ 1,688	3.6%	$ 141	0.8%	$ -	0.0%

1. Profit is used as a proxy for producer's surplus.

The above tables show the baseline economic impact of potential beneficiaries to Alternative 5. Here, that logic is extended into a range of benefit scenarios described in the introduction to this section. Table 3.27 shows the range of benefits based on certain assumptions about the increase in quality and the value elasticity of quality. By quality, we are referring to a composite attribute that takes into consideration the range of benefits that would have an impact on the non-consumptive recreation experience. This includes such attributes as diversity of wildlife, abundance of fish and invertebrates, the decrease in the density of users, the increase in water quality, etc. We use a range of a 10% increase to a 100% increase in quality. Value elasticity of quality is defined as the percentage increase in value associated with a one-percent increase in quality. For this illustration, we use a range of elasticities of 0.04 to 4.5. The valuation measure we use for this illustration is consumers' surplus associated with the boundary alternative, summed across all non-consumptive uses.

Table 3.27 presents a range of benefits with low end in terms of consumer's surplus of $492 with the assumption of a 10% increase in quality and a 0.04 value elasticity of quality and a high end of $553,874 with a 100% increase in value and a value elasticity of quality of 4.5. Income impacts increase to a range between $6,142 and $6,909,387, while employment impacts range between less than one job to 202 new jobs.

Table 3.27 Potential Benefits to Non-consumptive Users from Alternative 5 - Step 2 Analysis

Increase in Quality	Economic Measure	Elasticity of 0.04	Elasticity of 1.0	Elasticity of 4.5
10%				
	Consumer's Surplus	$ 492	$ 12,308	$ 55,387
	Income	$ 6,142	$ 153,542	$ 690,939
	Employment	0.18	4.50	20.23
	Person-days	43	1,063	4,784
50%				
	Consumer's Surplus	$ 2,462	$ 61,542	$ 276,937
	Income	$ 30,708	$ 767,710	$ 3,454,693
	Employment	0.90	22.48	101.17
	Person-days	213	5,315	23,918
100%				
	Consumer's Surplus	$ 4,923	$ 123,083	$ 553,874
	Income	$ 61,417	$ 1,535,419	$ 6,909,387
	Employment	1.80	44.96	202.34
	Person-days	425	10,630	47,835

1. Benefits are the aggregate amounts across all non-consumptive activities for Alterantive 5

Table 3.28. Summary: Economic Impacts on Recreation Non-consumptive Activities - Step 2 Analysis

	Range of Impacts							
	Person-days				Consumer's Surplus			
Alternative	Amount			%	Amount			%
Preferred Alternative	29	-	32,211	0.07% - 77%	$ 332	-	$ 372,969	0.07% - 77%
Alternative 1	11	-	12,092	0.03% - 29%	$ 124	-	$ 139,977	0.03% - 29%
Alternative 2	29	-	32,202	0.07% - 77%	$ 331	-	$ 372,875	0.07% - 77%
Alternative 3	11	-	12,092	0.03% - 29%	$ 124	-	$ 139,995	0.03% - 29%
Alternative 4	35	-	39,141	0.08% - 93%	$ 403	-	$ 453,195	0.08% - 93%
Alternative 5	43	-	47,835	0.10% - 114%	$ 492	-	$ 553,874	0.10% - 114%

	Income				Employment			
	Amount			%	Amount			%
Preferred Alternative	$ 4,169	-	$ 4,689,833	0.07% - 78%	0.12	-	135	0.07% - 75%
Alternative 1	$ 1,531	-	$ 1,721,895	0.03% - 29%	0.05	-	51	0.03% - 28%
Alternative 2	$ 4,122	-	$ 4,636,710	0.07% - 77%	0.12	-	133	0.07% - 74%
Alternative 3	$ 1,534	-	$ 1,725,785	0.03% - 29%	0.05	-	52	0.03% - 29%
Alternative 4	$ 5,000	-	$ 5,624,646	0.08% - 93%	0.15	-	164	0.08% - 92%
Alternative 5	$ 6,142	-	$ 6,909,387	0.10% - 115%	0.18	-	202	0.10% - 113%

1. Percents are percent of baseline 1999 for the entire study area.

Other Potential Benefits and Net Assessment

In previous sections we addressed the potential costs to all consumptive users (both the recreational industry and for the commercial fishery and kelp), we discussed the potential benefits to recreational consumptive users and commercial fisheries from the replenishment effect of the marine reserves. We also discussed the potential benefits to nonconsumptive recreational users and simulated the potential benefits using a range of assumptions about future quality increases in the marine reserves and the behavioral responses (quality elasticities). In the introduction of the report, we introduced the concepts of nonuse or passive economic use values. Here we derive some rough estimates for nonuse or passive use economic values using a conservative range of values from the economics literature and some assumptions about how many American households might be willing to pay for marine reserves in the CINMS. We summarize some key National and California Statewide surveys to provide underlying support for the notion that people are willing to pay for marine reserves. Lastly, we provide a rough assessment of the Net National Benefits of marine reserves in the CINMS. We do this by overstating the amounts of consumer's surplus losses for the commercial fisheries and kelp and consumptive recreation activities and use conservative lower bound estimates for nonuse or passive use economic values. Although we show a range of values for nonconsumptive recreation, these added benefits to change the outcomes of the Net Benefit Assessment. The net national benefits of marine reserves are greater than the costs by considering only the nonuse or passive use economic values for any of the alternatives proposed for the CINMS.

Nonuse or Passive Use Economic Value. To date there are no known studies that have estimated nonuse or passive use economic values specifically for the marine reserves in the CINMS or for marine reserves anywhere else. However, Spurgeon (1992) has offered two sets of identifiable factors, which will dictate the magnitude of nonuse or passive use economic values. First, nonuse economic values will be positively related to the quality, condition, and uniqueness of the ecosystem on a national or global scale. Second, the size of population, standard of education, and environmental perception of people in the country owning or having jurisdiction over the ecosystem will be positively related to nonuse or passive use economic values. Thus, nonuse or passive use economic values are determined by both supply and demand conditions. The existence of many similar sites would reduce the value. Although Spurgeon limits his scope to the people in the country owning or having jurisdiction over the ecosystem, people from all over the world may have nonuse or passive use economic values for ecosystem protection in other countries. Debt for nature protection swaps being conducted by The Nature Conservancy in South America is just one example. Legitimacy of including the values of people from other countries is more a judicial concern than an economic one. In some judicial proceedings people from other countries might not have legal standing over issues of resource protection and their economic values may be eliminated from inclusion in the proceedings.

What we know about nonuse economic values. We searched the literature and found 19 studies in which nonuse economic values were estimated. Desvouges et al (1992) contained summaries of 18 of the 19 studies. The remaining study was by Carson et al (1992) on the Exxon Valdez Oil Spill. Sixteen (16) of the 18 studies found in Desvouges et al (1992) reported values (not adjusted for inflation) of $10 or more per household per year for a broad variety of natural resource protection efforts. Of the two studies that reported values less than $10/household/year, one reported $3.80/household/year for adding one park in Australia and $5.20/household per year for a second park (these estimates were from a National sample of Australians). The other study that estimated nonuse economic values less than $10/household/year was a study of Wisconsin resident's willingness to pay for protecting bald eagles and striped shiners in the State of Wisconsin. For the bald eagle, nonuse economic values had an estimated range of $4.92 to $28.38/household/year, while for striped shiners the values ranged from $1.00 to $5.66/household/year. Total value ranged from $6.50 to $75.31/household/year.

Only two of the 18 studies summarized in Desvouges et al (1992) used National samples of U.S. households, the others were limited to state or region populations. The Exxon Valdez Oil Spill Study (Carson et al, 1992) used a National sample of U.S. households. An important caveat is that the sample included only English speaking households and eliminated Alaskan residents. Alaskan residents were eliminated to limit the sample to primarily nonusers of Prince William Sound (site of the oil spill) and non-English speaking households were eliminated because the researchers were not able to convert their questionnaires to other languages. The impact was that the sample represented only 90 percent of U.S. households.

Carson et al (1992) reported a median willingness to pay of $31 per household. The payment was a lump sum payment through income taxes and covered a ten-year period. The funds would go into a trust fund to pay for equipment and other costs necessary to prevent a future accident like the Exxon Valdez in Prince William Sound. After 10 years, double hull tankers would be fully implemented and the need for the protection program would expire. Mean willingness to pay was higher and more variable to model specification than the median willingness to pay, so the authors argued that the median value was a conservative estimate. Applying the $31/household to only 90 percent of the U.S. population of households was also considered conservative since non English speaking people probably have positive nonuse economic values as do Alaskans.

Estimation of Nonuse Economic Values. Given what we know about nonuse economic values, we can develop a range of "conservative" (i.e., lower bound) estimates of nonuse or passive use economic values for the marine reserves in the CINMS. To do this requires the following assumptions and facts:

Assumptions:

1. One (1) percent of U.S. households would have some positive nonuse or passive economic use values for a network of marine reserves in the CINMS.
2. The one (1) percent of U.S. households would be, on average, willing to pay either $3/household/year, $5/household/year, or $10/houshold/year for marine reserves in the CINMS.

Fact:

1. As of July 1, 1999, there were 103.9 million households in the U.S.

Using the above assumptions and the number of U.S. households in 1999, we can estimate a probable lower bound set of estimates for the nonuse or passive use economic values for the network of marine reserves in the CINMS.

	$3/household/year	$5/household/year	$10/household/year
1999 Annual Amount	$3.12 million	$5.19 million	$10.39 million

The 1999 annual willingness to pay for marine reserves in the CINMS would range between $3.12 million and $10.39 million, depending on the assumed willingness to pay per household. We would expect that nonuse economic values would be greater the larger the area protected. But as described earlier, we would also expect willingness to pay to be positively related to both the characteristics of those valuing the reserve and the characteristics of what they are asked to value. Since our estimates of nonuse economic values are based on an assumed range of values (at the lowest end of the distribution of values estimated in other studies), we are not able to compare the values of the different alternatives in dollar terms. However, following the suggestions of Spurgeon, we demonstrate the characteristics of the U.S. population that would support our statement that the above estimates would likely be lower bound estimates.

Factors Supporting Positive Nonuse Economic Value. We reviewed four studies based on National surveys of U.S. households that evaluated adult's perceptions and concerns about the environment. In addition, one of the studies focused specifically on ocean related issues (SeaWeb, 1996) and found strong support for marine protected areas. One more recent study (SeaWeb, 2001) directly addressed the issue of marine protected areas and fully protected marine reserves. Each of the surveys demonstrated that U.S. citizens have a high level of concern about the environment and believe the environment is threatened and requires action and overwhelming support the creation of marine reserves. One recent study based on a survey of Californians (SeaWeb, 2002) found support for the California MLPA and for marine reserves in the CINMS. Also, our assumption that only one (1) percent of U.S. households would be willing to pay for marine reserves in the CINMS would appear to be a conservative lower bound estimate since the Roper survey (Roper, 1990) indicated that in 1990 eight (8) percent of U.S. households made financial contributions to environmental organizations. Selected results from the five studies are summarized below.

Environmental Opinion Study, Inc. National sample of 804 households conducted May 18-26, 1991.

Identification with Environmental Label

	%
Strong Environmentalist	31
Weak Environmentalist	29
Lean Towards Environmentalism	30
Neutral	6
Anti-Environmentalist	4

Roper 1989 and 1990 National Surveys

1. Things the Nation Should Make a Major Effort on Now

	1989 (%)	1990 (%)
a. Trying to solve the problem of crime and drugs	78	88
b. Taking steps to contain the cost of health care	70	80
c. **Trying to improve the quality of the environment**	**56**	**78**
d. Trying to improve the quality of public school education	N//A	77
2. Contribute money to environmental groups	7	8

SeaWeb 1996. National Sample of 900 U.S. Households (May 1-15, 1996)

1. Condition of the ocean	49% very important	38% somewhat important
2. Destruction of the ocean on Quality of Life		
a. Today	52% very serious	35% somewhat serious
b. 10 years from now	63% very serious	23% somewhat serious
3. Oceans threatened by human activity		82% agree
4. The federal government needs to do more to help protect the oceans		85% agree to strongly agree
5. Destruction of ocean plants/ animals		56% very serious problem
6. Overfishing by commercial fishermen		45% very serious problem
7. Deterioration of coral reefs		43% very serious problem
8. Protect sanctuaries where fishing, boating, etc, prohibited		62% strongly agree
9. Support efforts to set up Marine Sanctuaries		24% say they are almost certain to take this action
10. Marine sanctuaries where no human activity is permitted		19% say they are almost certain to take this action

SeaWeb 2001, A combination of two studies.

1. **Attitudes Toward Marine Reserves, National Sample of 1,000 Adult Americans Nationwide, February 9-11, 2001**

2. **Public Attitudes Toward Protected Areas in the Ocean, National Sample of 802 Adult Americans Nationwide, September 25, 1999 to October 3, 1999**

Summary of Key findings:

- **Most Americans have a fairly Negative View of the Overall Health of the Oceans** (44% - Only Fair, and 15% - Poor for a total of 59% with Negative ratings)
- **Nearly Two-thirds believe that regulations protecting the ocean are too lax** (63% - regulations are not strict enough)
- **Pollution, Contaminated Seafood, and Dirty Beaches Top the list of ocean concerns. Recreation-related concerns are seen as less serious.**
- **Large majorities find the condition of both "Coastal" and "Deep Sea" Waters Important**
  "How important is the condition of _____ to you personally?"
  Coastal Waters (69% very important and 23% somewhat important)
  Deep Sea (53% very important, 30% somewhat important)
- **Americans believe a far greater percentage of our ocean waters are fully protected than actually are.**
  "As you may know, there are different kinds of protected areas in American oceans – some are fully protected and allow no human activities that could harm the ocean environment at all. Other kinds of protected areas have lower levels of protected areas and ban only certain activities. What percentage of U.S. waters do you think are fully protected – that is, allow no human activities that could harm the ocean environment at all?"
  On average, Americans believe 22% of the oceans is fully protected.
- **Only one-third of Americans are even dimly aware of the existence of Marine Sanctuaries.**
  "Do you happen to know whether or not the federal government has established certain areas of the ocean as marine sanctuaries – or don't you happen to know?"
  (Yes-do know, 33%, No-don't know, 17% and Don't Know, 50%)

- **Most Americans think there are too few Marine Sanctuaries.**
  "Currently there are 12 areas of the ocean in US territorial waters that are designated as marine sanctuaries. Do you think that is too many, about the right number, or too few?"
  (Too Few-60%, About Right-19%, Too Many-3%, Don't Know-18%)
- **Support for Strengthening Protections in the 12 Marine Sanctuaries is Overwhelming.**
  "There are currently 12 marine sanctuaries in United States territorial waters which total about 1% of US waters and there are few restrictions on recreational or commercial activities within the sanctuaries. Do you think that we should increase protections that restrict human activities within the sanctuaries or do you think we should not increase protections that restrict human activities within marine sanctuaries in U.S. waters or don't you have an opinion on this?"
  (Increase Protections-75%, Do not Increase Protections-10%, Don't Know-15%)
- **A plurality think of the ocean as a habitat for marine creatures. Only a minority thinks of the ocean in purely instrumental terms.**
  "Which of the best describes how you mainly think of the ocean?"
  - *As a habitat for the fish, marine creatures and plants that live in the ocean (41%)*
  - *As a spiritual place important to human life on earth (13%)*
  - *As a place for recreation such as swimming, boating, fishing, and vacationing (17%)*
  - *As an important source of food (15%)*
  - *As an important resource for oil and transportation (6%)*
  - *Other or don't know (8%)*
- **At the same time, People are not sure exactly how ocean systems work. Most, but far from all, think fish breeding grounds and coral reefs are found only in particular places.**
  "As far as you know, do most species of fish breed all throughout the ocean or do various species of fish breed in particular places within the ocean or don't you have an opinion on this?"
  (All Over-14%, Particular Places-63%, Don't Know-24%)
  "As far as you know, are coral reefs only found in certain areas of the ocean or are they found all throughout the ocean or don't you have an opinion on this?"
  (Throughout-26%, Certain areas-56%, Don't Know-18%)
- **On the other hand, most feel that pollution in one area affects the whole ocean…..**
  "As far as you know, does pollution entering on area of the ocean affect the entire ocean, or does it mostly affect the area of the ocean near the source, or don't you have an opinion on this?"
  (Entire Ocean-58%, Area Near Source-34%, Don't Know-8%)

- **…Which results in division on whether the ocean has unique areas that can be protected.**
  "Which of the following statements comes closest to your own view: the ocean, like the land, has certain areas that are unique and can be protected from pollution or overfishing <u>OR</u> The ocean is one giant body of water and protecting one particular area of it from pollution or overfishing is useless since anything that is done in one part of the ocean will affect every other part or don't you have an opinion on this?"
  (Unique Areas-47%, One Giant Body-43%, Don't Know-10%)
- **Yet, when these areas are described, support for protected areas is broad and strong.**
  "Do you favor or oppose the United States having certain areas of the ocean within U.S. territorial waters as ocean protected areas in which activities that can result in pollution, seriously deplete fish or marine life, or damage important underwater habitat such as coral reefs and other special places are limited, or don't you have an opinion on this?"
  (Favor-75%, Oppose-10%, Don't Know-15%)
- **Overwhelming public support for the Clinton Executive Order on marine reserves (from Feb., 2001 Survey)**
  "Last May, former President Clinton signed an executive order calling on states, local governments and non-governmental organizations to create a system of protected areas in the oceans off the U.S. coasts. Do you favor or oppose this executive order to establish a system of marine protected areas in U.S. waters?"
  (Favor-83%, Oppose-16%, Don't Know-2%)
- **Top goals for ocean protected areas focus on dumping and pollution, followed by protection of sea life and habitats. Middle tear goals focus on management of commercial enterprise.**

- **Americans see a value in fully protected marine reserves with no exceptions for even recreational activities.**
  "We need some areas that are fully protected, even from recreational activities" (63%)
  "It is not right to prohibit individual recreational use of the ocean" (16%)
  "Don't Know" (21%)
- **The public finds scientific consensus to be a compelling reason to support fully protected marine areas.**
  "Leading marine scientists issued a statement recently saying that we need fully protected ocean areas that prohibit all invasive and extractive human activities, both recreational and commercial. These scientists say that the research shows that full protection in these areas leads to more robust and diverse marine life within the area, and also provides greater benefits to ocean habitat and marine life outside the protected area. How convincing is this as a reason to support fully protected ocean areas?"
  (Convincing-77%, Not Convincing-21%, Not Sure-2%)
- **A simple statement that we protect less than 1% of our ocean waters is very compelling to the public.**
  "Currently, we only protect less than 1% of US waters. To preserve this beautiful resource, we need to protect more. How convincing is this as a reason to support fully protected ocean areas?"
  (Convincing-88%, Not Convincing-9%, Not sure-3%)

SeaWeb 2002. Survey of 1,000 likely voters in California (January 8-16, 2002)

Summary of key findings:

- **64% say overall health of California's ocean is fair-to-poor**
- **62% say health of marine life, fish and mammals that live in California's ocean waters is only fair-to-poor**
- **56% say the abundance of marine life in state ocean waters is fair-to-poor**
- **22% believe their state's ocean waters are fully protected from all human activities that can harm the ocean environment.**
- **There is strong support for establishing fully-protected areas in the ocean in which all extractive activities are prohibited, including oil drilling, mining and all commercial and recreational fishing. 71% support establishing such areas in California's ocean waters, and 55% strongly support their establishment, while 15% are opposed.**
- **Even when respondents are told they might loose personal access to parts of the ocean, 69% continue to support full protected areas, while 16% are opposed.**
- **When told that the Marine Life Protection Act "provides for the establishment of a range of protected areas from fully protected with no commercial or recreational activities to those that allow all recreational and most commercial activities," 85% say it is important that the MLPA result in at least some percentage of California's ocean being fully protected from all commercial and recreational activities.**
- **65% say that the long-term benefits of a healthier and more abundant resources, including fish populations and increased tourism to restored ocean places is more important than the short-term costs in jobs, higher prices for goods and services and impacts on people whose incomes depend on ocean resources. Only 14% feel that short-term costs should take precedence.**
- **83% agree with the statement, "I am willing to give up personal access to certain places in the ocean just so there can be some places that are fully protected from all human use (59% strongly agree)**
- **89% agree that, "Individuals and businesses that use ocean resources have a responsibility to leave critically important habitat and nursery grounds for fish and marine mammals untouched" (66% strongly agree)**
- **80% agree that, "Protecting less than 1% of California's ocean from all commercial and extractive activities is not enough *55% strongly agree)**

The U.S. population is certainly a high income and highly educated population and, as the results above predictably show, the U.S. and California population has high environmental concern and overwhelmingly supports the creation of marine reserves. Characteristics of the people valuing the reserve would be constant (U.S. Households) across different proposed marine reserve boundary alternatives. To differentiate among alternatives would require that we compare some measurements that would serve as indicators of the relative quality, condition and uniqueness of the proposed reserves across alternatives. We have some information compiled on 15 habitat types protected by each alternative.

Alternative 1. This alternative is the smallest in size at approximately 186.5 nautical square miles and overall protects 12 percent of CINMS waters. Only three of the 15 habitats receive 20 percent or more of protection and only two habitats receive more than 30 percent protection. This alternative should have the lowest nonuse or passive economic use value.

Alternative 2. This alternative is the second smallest in size at approximately 213.1 nautical square miles and overall protects 14 percent of CINMS waters. Only four of the 15 habitats receive 20 percent or more of protection and only one habitat receives more than 30 percent protection. People may not be able to distinguish this alternative from alternative 1 without more information.

Alternative 3. This alternative is the third smallest in size at approximately 306.5 nautical square miles and overall protects 21 percent of CINMS waters. Only six of the 15 habitats receive 20 percent or more of protection and only two habitats receive more than 30 percent protection. This alternative would be expected to have higher nonuse or passive use economic value than alternatives 1 and 2.

Alternative 4. This alternative is the second largest in size at approximately 450.1 nautical square miles and overall protects 29 percent of CINMS waters. 14 of the 15 habitats receive 20 percent or more of protection and six habitats receive more than 30 percent protection. This alternative would be expected to have higher nonuse or passive economic use value than alternatives 1,2, 3 and the preferred alternative.

Alternative 5. This alternative is the largest in size at approximately 516.4 nautical square miles and overall protects 34 percent of CINMS waters. All 15 habitats receive 24 percent or more of protection and nine habitats receive more than 30 percent protection. This alternative would be expected to have the highest nonuse or passive use economic value among all alternatives.

Preferred Alternative. This alternative is mid-range in size at approximately 369.6 nautical square miles and overall protects 25 percent of CINMS waters. All 15 habitats receive 21 percent or more of protection and eight habitats receive more than 30 percent protection. This alternative would be expected to have nonuse or passive use economic value somewhere between that between alternatives 3 and 4.

Scientific and Education Values. Marine reserves provide a multitude of benefits. Sobel (1996) provides a long list of these benefits. Most of those benefits have been covered in Chapter 1 and 2 and in our discussion of nonuse economic benefits above. Scientific and education values were categorized by Sobel into those things a reserves provides that increase knowledge and understanding of marine systems. Sobel provides the following lists of benefits:

Scientific

- Provides long-term monitoring sites
- Provides focus for study
- Provides continuity of knowledge in undisturbed site
- Provides opportunity to restore or maintain natural behaviors
- Reduces risks to long-term experiments
- Provides controlled natural areas for assessing anthropogenic impacts, including fishing and other impacts

Education

- Provides sites for enhanced primary and adult education
- Provides sites for high-level graduate education

We cannot quantify these benefits, but they are extremely important.

Net Assessment

Here we provide a net assessment using the National Net Benefits Approach. Under this approach, only consumer's surplus and economic rent values are appropriate for consideration, as in a formal benefit-cost analysis. We are not able to quantify all the costs and benefits, especially not across all alternatives, as with the nonuse or passive economic use values. But with certain assumptions designed to bias the result in favor of the consumptive activities, we show that the nonuse or passive economic use values would likely exceed all consumptive use values. ***Thus, there would be net national benefits to adopting any of the alternatives for the proposed marine reserves in the CINMS.***

Commercial Fishing and Kelp. We concluded in Chapter 1 that the supplies of CINMS caught commercial fish were not a high enough proportion of total supply to affect prices, except possibly if you eliminated the entire supply of squid and urchins caught in the CINMS. The proportions of supply impacted by each marine reserve alternative would be far too small to impact prices and consumer's surplus impacts from each alternative would be zero. Also, we have found no evidence that economic rents exist in the CINMS fisheries. For the largest commercial fishery, squid, there appears to be economic overfishing and possibly negative economic rents. However, we decided that without definitive analysis, we would assume $8 million in consumer's surplus and economic rents for the CINMS commercial fisheries. This is a little higher than what we estimated for the Florida Keys National Marine Sanctuary for the entire Tortugas area. We then assume if you remove the amounts displaced in Step 1 analyses (Chapter 2) for each alternative and simply take the percent of ex vessel revenue lost times $8 million, we arrive at estimates for a rough comparison with nonuse or passive economic use values. This procedure is not technically correct and overstates the commercial fishing values and so biases the comparison in favor to the commercial fisheries.

Recreation Consumptive Activities. We use our Step 1 analysis estimates and ignore the offsetting factors discussed at the beginning of this chapter that indicate much of the losses in Step 1 would not likely occur. Again, the effect here will be to bias the analysis towards the consumptive users.

Nonconsumptive Recreation Activities. We simulated a range of potential benefits for a portion of the group that we were able to include in our analyses, i.e., those doing nonconsumptive activities using the for hire or charter/party/guide boat businesses. We were not able to find any information to estimate the amount of nonconsumptive use from private household/rental boats in the CINMS. We include a mid-range and upper range of values estimated for the charter/party/guide boat nonconsumptive users. Because the nonconsumptive private household boat use is not included, again our estimates are biased towards the consumptive users.

Table 3.29 summarizes the results of our National Net Benefits Assessment. The "+" at the bottom of the table means that, when comparing only the nonuse or passive economic use values with the sum of the consumptive use values, the nonuse or passive economic use values are always higher. This is true whether one compares consumptive use values with either the lowest, mid-range or highest nonuse or passive use economic values. ***Thus, we can conclude there would be net national benefits from adopting any of the marine reserve alternatives for the CINMS, even when estimates for consumptive users are biased upwards and we compare them with the lowest potential nonuse or passive use economic values.***

Table 3.29. Net Assessment: National Net Benefits of Marine Reserves in the CINMS

Use	Alternatives 1	2	3	4	5	Preferred
Costs						
Recreation Consumptive	$ 471,006	$ 832,222	$ 535,789	$ 1,024,276	$ 1,209,945	$ 902,077
Commercial Fisheries and Kelp	$ 615,200	$ 632,000	$ 674,400	$ 1,179,200	$ 1,462,400	$ 924,000
Total Consumptive	$ 1,086,206	$ 1,464,222	$ 1,210,189	$ 2,203,476	$ 2,672,345	$ 1,826,077
Benefits						
Recreation Non-consumptive						
Mid-range (50% quality increase, elasticity 1.0)	$ 15,553	$ 41,431	$ 15,555	$ 50,355	$ 61,542	$ 41,441
Highest (100% quality increase, elasticity 4.5)	$ 139,977	$ 372,875	$ 139,995	$ 453,195	$ 553,874	$ 372,969
Nonuse/Passive Economic Use						
Lowest ($3.12 million)	+	+	+	+	+	+
Mid-range ($5.19 million)	+	+	+	+	+	+
Highest ($10.39 million)	+	+	+	+	+	+

1. "+" means nonuse values higher than consumptive use values.

Net National Benefits Approach versus Local Income and Employment

Economists for years have been trying to explain cost-benefit analysis or the net national benefits approach. Even though cost-benefit analysis has been widely excepted in public policy and management many still don't understand the concepts of consumer's surplus, producer's surplus or economic rent used by economists in cost-benefit analysis. Many understand sales, income and employment numbers and how this relates to their local economies. But, generally these measures are not appropriate inputs into the cost-benefit calculation. They enter the analysis indirectly when one of the major assumptions of cost-benefit analysis is violated i.e., that the economy is at full employment and any displaced capital or labor can easily find employment. When the economy is not at full employment or capital and labor cannot simply find alternative employment, this leads to real economic costs that must included. There are also issues of equity or fairness that are not addressed in cost-benefit analysis. To address this issue some public agencies have asked that the distribution of costs and benefits be included in analyses.

The net national benefits approach versus the local income and employment approach partially addresses this question of the distribution of benefits and costs. As we showed above in the net national benefits exercise, the main benefits of marine reserves came from national sources that are highly dispersed across the country. Nonuse or passive economic use values will be dispersed widely across people throughout the country. There is no income and employment impacts associated with nonuse or passive use values, except the media sources, which are the basis for people finding out about the resources they value. Consumer's surplus values from changes in supply of commercial fishing products are also widely dispersed and, for many CINMS species, consumers would include foreign consumers. The potential income and employment impacts are largely concentrated in the local communities adjacent to the CINMS. If there are trade-offs, they might entail distributions of national benefits with most of the costs born locally. This is true for many goods and services where there might be high net national benefits, but the costs are concentrated (e.g. pollution and undesirable industrial development) in local areas. Oil and gas development is certainly one of these types of issues. Benefits are often small per individual dispersed across the whole country, while costs are high per a small number of individuals concentrated in local areas.

Why don't economists want to include income and employment impacts in cost-benefit analysis? The general answer is that is people don't spend their money on one thing they will spend it on something else. So, one person's loss is another person's gain. This is the issue of substitution we discussed in our Step 2 analysis, but on a broader scale. If someone is displaced from their favorite recreational fishing spot and decide to not go fishing, but instead go to out to a restaurant and see a movie. This too has sales, income and employment impacts that would partially or even fully off set the sales, income and employment impacts in the local economy of the lost fishing day. If people don't go fishing or diving, they will do something else and that something else will generally involve some activity which requires some spending. That spending will partially or fully off set the impacts on sales, income and employment. There may be different patterns of spending. And, it may be an issue of one person's loss is another person's gain. The

net effect could be zero, in terms of total local sales, income and employment, or it could be lower sales, income and employment locally, but no difference from a State, Region or National perspective. The same is not true for the net national benefits approach. The concepts of consumer's surplus, producer's surplus and economic rents are net benefits and costs. They may have different distributions, but they are by definition net benefits and costs and do not cancel each other out. This is why economists don't include income and employment in cost-benefit analyses.

End Notes

1. Some confusion exists about open access fisheries. For economic analysis, it is critical to understand the structure of who can enter the fishery, if there are constraints on the amount and timing of total take allowed, and what is the current capacity to catch the fish stock.

   Case 1. A permit system where all you have to do is buy a permit and you are allowed to fish. And, the fishery has some total allowable take, but not specified by fishermen (first come first serve). The economic analysis of open access fisheries applies.

   Case 2. A permit system where all you have to do is buy a permit and you are allowed to fish, except the number of permits is limited. However, the capacity of the fleet is such that they could catch the entire stock of fish. One might describe this as limited entry, but it has no real effect economically or biologically because of the capacity of the fleet. This would still be analyzed as an open access fishery.

   Case 3. A permit system where all you have to do is buy a permit and you are allowed to fish, except the number of permits is limited. In this case, the number of permits and the capacity of the fleet is controlled to where it cannot exceed total allowable catch. Still do not have Individual Transferable Quotas, but there is the possibility of the participants in the fishery earning economic rents. This would not be analyzed as an open access fishery. This is likely to be a derby fishery, still not the economically efficient solution, but not the open access fishery.

   Case 4. Individual transferable Quotas (ITQs). A limited number of fishermen are given ITQs, which specify a certain share of the total allowable catch. This avoids the derby fishery problem and since one can buy and sell the ITQs, it solves the capacity problem and fosters economic efficiency. Not open access.

   It would appear that all the CINMS fisheries fir either Case 1 or 2 and can be analyzed as open access fisheries.

2. Because the Pomeroy Sample surveys were undertaken during the off season for squid, the squid/wetfish sample under-represents squid fishery participants from Washington and, to a lesser extent, those from California who were fishing in Alaska at the time of the study. The representativeness of the Barilotti Sample is also limited, due in large part to the greater participation of Santa Barbara fishermen, and the more limited participation of Ventura and Channel Islands Harbor fishermen.

3. On monopoly in the squid fishery, Hackett (in press) writes, “California receiver/processors can be characterized as oligopsonists (few buyers, relative high concentration, and costly entry) in the market for fish. It is important to note, however, that a more concentrated market structure (such as oligopsony) does not necessarily imply that firms can exercise market power, and the question of market power is beyond the scope of this report.”

4. Economic overfishing does not necessarily lead to exit from the fishery, especially if social, economic and/or regulatory conditions limit participants’ alternatives. The squid fishery is only one component of the larger wetfish fishery (in geographic and species terms), such that economic overfishing of squid may be offset by emerging opportunities with other species (e.g., sardine). Moreover, recent and pending regulatory changes have led to and will likely lead to further changes in this situation.

5. This outcome may or may not be realized, depending on the extent of overcapitalization prior to implementing ITQs and to the extent to which ITQs actually reduce capacity – which will depend on how the ITQ program is designed.

6. Bird Watching was estimated at 2.6 million participants, Viewing Other Wildlife at about 2.6 million participants, and Viewing or Photographing Scenery at about 4.2 million participants. The total of 6.3 million participants in all viewing activities eliminates double counting due to the fact that people participate in multiple activities. There may be some double counting in days of activity as well.

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